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THESIS

ANALYSIS OF THE INTEGRATED DEFENSE ACQUISITION, TECHNOLOGY, AND LOGISTICS LIFE CYCLE MANAGEMENT FRAMEWORK FOR HUMAN SYSTEMS INTEGRATION DOCUMENTATION

by

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ABSTRACT

The objective of this thesis is to conduct a thorough analysis of the documentation and policy that currently exists within the Department of Defense (DoD) framework. There are numerous gaps within this documentation pertaining to Human Systems Integration (HSI) in the Integrated Defense Acquisition, Technology, and Logistics (IDAT&L) Life Cycle. The U.S. Navy currently implements HSI at different stages throughout the Life Cycle, but it lacks continuity throughout the entire process. A detailed analysis of the IDAT&L framework can potentially aid in redefining how the Navy should address HSI, by identifying areas where HSI policies and guidelines should exist, but currently do not (i.e., gaps), and then proposing ways to close those gaps and streamline the HSI process as a whole throughout the Navy. This thesis suggests a potential, strengthened framework for HSI in the Navy, based on the information and findings gathered from not only the current framework, but also current Navy policies. The outcome of this thesis is to improve the entire HSI process throughout the Navy and help ensure that HSI is used effectively throughout the acquisition process.

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LIST OF SYMBOLS, ACRONYMS, AND ABBREVIATIONS

AoA	Analysis of Alternatives
AT&L	Acquisition, Technology and Logistics
CDD	Capabilities Development Document
CDR	Critical Design Review
CJCS	Chairman of the Joint Chiefs of Staff
CJCSI	Chairman of the Joint Chiefs of Staff Instruction
COI	Critical Operational Issues
CPD	Capabilities Production Document
CPI	Critical Program Information
CTP	Critical Technical Parameters
DAG	Defense Acquisition Guide
DAU	Defense Acquisition University
DoD	Department of Defense
DoDD	Department of Defense Directive
DoDI	Department of Defense Instruction
DoN	Department of Navy
DOTMLPF	Doctrine, Organization, Training, Materiel, Leadership and Education, Personnel and Facilities
DT&E	Developmental Test and Evaluation
EMD	Engineering and Manufacturing Development
FNA	Functional Needs Analysis
GAO	General Accounting Office
HARDMAN	Hardware Procurement and Military Manpower
HARPS	Human Analysis and Requirements Planning System
HCI	Human Computer Interface
HSI	Human Systems Integration
HSE	Human Systems Engineering
ICD	Initial Capabilities Document
IA	Integrated Architecture
IDAT&L	Integrated Defense Acquisition, Technology & Logistics

ISP	Information Support Plan
JCIDS	Joint Capabilities Integration Development Systems
KPP	Key Performance Parameters
LFT&E	Live Fire Test and Evaluation
MDA	Milestone Decision Authority
MPT	Manpower, Personnel and Training
MPTS	Manpower, Personnel, Training and Safety
MSA	Materiel Solutions Analysis
MANPRINT	Military and Manpower Integration
NASA	National Aeronautics and Space Administration
NAVAIR	Naval Air Systems Command
NAVSEA	Naval Sea Systems Command
OPNAV	Office of the Chief of Naval Operations
OPNAVINST	Office of the Chief of Naval Operations Instruction
OS	Operations and Support
OT&E	Operational Test and Evaluation
PD	Production and Deployment
PDR	Preliminary Design Review
PESHE	Programmatic Environment, Safety and Health Evaluation
PM	Program Manager
RFP	Request for Proposal
SECNAV	United States Secretary of the Navy
SECNAVINST	United States Secretary of the Navy Instruction
SOW	Statement of Work
SPAWAR	Space and Naval Warfare Systems Command
SYSCOM(s)	U.S. Navy Systems Command(s)
TD	Technology Development or Technology Development
T&E	Test and Evaluation
USN	United States Navy
VSYSCOM	Virtual Systems Command

EXECUTIVE SUMMARY

The objective of this thesis is to conduct a thorough analysis of the documentation and policy that currently exists within the Department of Defense (DoD) framework. There are numerous gaps within this documentation pertaining to Human Systems Integration (HSI) in the Integrated Defense Acquisition, Technology, and Logistics (IDAT&L) Life Cycle. The U.S. Navy currently implements HSI at different stages throughout the Life Cycle, but it lacks continuity throughout the entire process. A detailed analysis of the IDAT&L framework can potentially aid in redefining how the Navy should address HSI, identifying areas where HSI policies and guidelines should exist, but currently do not (i.e., gaps), and then proposing ways to close those gaps and streamline the HSI process as a whole throughout the Navy.

The acquisition process contains a thorough structure from the moment a need for the military is identified to the moment that the need is retired and disposed. This process guides the acquisition community through the important steps to obtain a system that will meet the standards that are required. Within each phase of the Life Cycle, the Program Manager (PM) is required to meet these standards. Every member of the acquisition team, from the user to the engineer, knows what is required during this process of the Life Cycle.

HSI is a growing field that requires complete immersion into the acquisition process. As of yet, it has not been fully integrated throughout all of the phases. In order to obtain and develop the best system for the military, the acquisition community must gain the knowledge of the system and the user. In order to develop the system with the user in mind, the acquisition cycle must integrate HSI throughout the entire process. The integration of these HSI standards will allow the PM and his/her team to acquire the best system to meet the needs of the military.

The development of a model that would serve as our baseline allowed us to do a gap analysis on the policies and documentation within the U.S. Navy's acquisition process. The gap analysis provided us with the gaps between the HSI standards (our model) and what the policies and documents say is required. The recommendations are provided to gain knowledge on how the process could be changed in order to obtain the best system for the military. This model was developed with the U.S. Navy as the main priority, but may also be useful for the other services.

Based on the comparative analysis of the current HSI policies and procedures utilized by the Navy, and the gaps identified in the guidelines and policies reviewed, this thesis makes recommendations for a joint framework for a new comprehensive policy throughout the IDAT&L Life Cycle Management Process. These recommendations intend to improve the efficiency and effectiveness of the acquisition process and the further development of HSI.

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I. INTRODUCTION

A. PURPOSE

The objective of this thesis is to analyze the documentation and policy that currently exists within the Department of Defense (DoD) framework dealing with the Integrated Defense Acquisition, Technology, and Logistics (IDAT&L) Life Cycle focusing specifically on how the United States Navy addresses Human Systems Integration (HSI). Currently, the Navy implements HSI at different stages throughout the Life Cycle. An analysis of the IDAT&L framework can potentially aid in understanding how the Navy should address HSI, identifying areas where HSI policies and guidelines should exist, but do not (i.e., gaps), and then proposing ways to close those gaps. This thesis is a potential strengthened framework for the Navy, based on the information and knowledge gathered from not only the current framework, but also from current Navy policies. The objective of this thesis is to improve the entire HSI process.

B. BACKGROUND

HSI and the Defense acquisition process are inextricably linked. In order to understand how the Defense Acquisition System works, it is critical to understand its structure and direction. The foundation of the acquisition process lies at the roots of HSI. Without a solid footing in one, the other cannot be successful. The Defense Acquisition System, by definition, is a

> . . . management process by which the Department of Defense acquires quality products in a timely manner, at a fair and responsible price, and which satisfies user needs with measureable improvements to mission capability and operational support. The Defense Acquisition System exists to manage the nation's investments in technologies, programs, and product support in such a way so as to achieve the National Security Strategy to support not only today's armed forces, but also the next force and future forces beyond that. (Naval Air Systems Command (NAVAIR) Acquisition Guide, 2008, p. 6)

HSI is thought to be a process of incorporating characteristics, capabilities, and limitations of humans within the IDAT&L decision-making process. However, no set definition has been agreed on by HSI practioners. A leading pioneer in the field of HSI, Harold R. Booher, defines HSI in his book, *Handbook of Human Systems Integration* (2003), as: ". . . a comprehensive management and technical program that focuses on the integration of human considerations into the systems acquisition process" (p. 5). The DoD *Handbook on Human Engineering Process and Procedures*, MIL-HDBK-46855A, defines HSI as:

> A comprehensive management and technical strategy to ensure that human performance, the burden design imposes on manpower, personnel, and training (MPT), and safety and health aspects are considered throughout system design and development. HSI assists with the total system approach by focusing attention on the human part of the total system equation and by ensuring that human-related considerations are integrated into the system acquisition process. (MIL-HDBK-46855A, Section 5.1.2, 1999, p. 19)

The Naval Postgraduate School defines HSI as:

> HSI acknowledges that the human is a critical component of any complex system. It is an interdisciplinary approach that makes explicit the underlining tradeoffs across the HSI domains, facilitating optimization of total system performance. (Miller & Shattuck, 2006, p. 4)

The National Aeronautics and Space Administration (NASA) defines HSI on their NASA Ames HSI Webpage as:

> . . . an umbrella term for several areas of 'human factors' research that include human performance, technology design, and human-computer interaction. The study of Human Systems Integration at NASA Ames Research Center focuses on the need for safe, efficient and cost-effective operations, maintenance and training, both in space, in flight and on the ground. (NASA Ames HSI Website, 2009)

As can be seen from the definitions above, HSI practioners do not agree on a formal definition of HSI. Given the interdisciplinary nature of this field, arriving on a set definition is imperative as a first step in seeing a successful joint IDAT&L framework. Ideally, all DoD components should understand and agree on the definition of the field in which they are required to work.

Based on the “reality” that HSI practioners and DoD-related agencies do not agree on a common definition, it is not surprising that they do not agree on common domains within HSI. The seven domains of HSI are listed in MIL-HDBK-46855A, the DoD *Handbook on Human Engineering Process and Procedures*: Human Factors Engineering, Manpower, Personnel, Training, Safety, Health Hazards, and Human Survivability (1999).

Department of Defense Instruction (DoDI) 5000.02, which was revised in 2008,

> . . . establishes a simplified and flexible management framework for translating mission needs and technology opportunities, based on approved mission needs and requirements, into stable, affordable, and well managed acquisition programs that include weapon systems and automated information systems. (DoDI 5000.02, 2008, p. 1)

This instruction applies to all services within the DoD and defines the domains of HSI as: Manpower, Personnel, Training, Human Factors Engineering, Survivability, Habitability, Environment, Safety, and Occupational Health (DoDI 5000.02, 2008). Although these domains are defined in the above document, each service has redefined domains based on their mission requirements. Table 1 shows disparities among the services in the HSI domains. Like a common definition, agreeing on domains is essential to a successful joint acquisition strategy.

Table 1. Service HSI domains (After: Miller & Shattuck, 2006)

NAVY	ARMY	AIR FORCE	MARINE CORPS	NASA
Manpower	Manpower	Manpower	Manpower	Manpower
Personnel	Personnel	Personnel	Personnel	Personnel
Training	Training	Training	Training	Training
Human Factors Engineering	Human Factors Engineering	Human Factors Engineering	Human Factors Engineering	Human Factors/ Human Factors Engineering
Human Survivability	Soldier Survivability	Human Survivability	Human Survivability	Survivability
System Safety	System Safety	System Safety	System Safety	System Safety, Environmental Safety, Occupational Safety
Health Hazards	Health Hazards	Occupational Health Hazards	Health Hazards	Health, Medical Hazards
Habitability		Habitability	Habitability	Habitability
		Environment		

HSI sprang from problems in implementing the IDAT&L Life Cycle Management Framework. Although the field of human factors has existed for decades, the interdisciplinary field of HSI began to emerge after a 1981 General Accounting Office (GAO) report attributed 50% of all military equipment failures to human error (GAO, 1981).

> The report confirmed that the effectiveness of U.S. forces could be significantly increased through improved weapon system design. Further, it stressed the immediate need for the integration of manpower, personnel, and training (MPT) considerations into the acquisition process. (Belcher, 1995, p. 3)

The recognition of this deficiency led to the birth of two DoD programs: Hardware Procurement and Military Manpower (HARDMAN) for the Navy and Military and Manpower Integration (MANPRINT) in the Army. These programs were designed to improve human performance and equipment reliability, while helping to weed out system design flaws.

In December 1988, the DoD published Directive 5000.53, entitled “Manpower, Personnel, Training, and Safety (MPTS) in the Defense Acquisition Process.” This document helped establish common MPTS criteria among all services, but was superseded soon after by DoDI 5000.2, "Defense Acquisition Management Policies and Procedures," in February 1991. This new document "mandated that human considerations shall be effectively integrated into the design effort for defense systems to improve total system performance and reduce ownership costs" (DoD , 2003, p. 43).

Although the 2003 version of DoDI 5000.2 outlined the requirement for HSI, the method of implementation was left to each individual service. Because each service owns "HSI," the term "Human Systems Integration" gets thrown around quite often; however, few individuals know how it works and how it should be implemented. With that being said, each service has created a unique method for implementing it within the confines of that service, but there is still little agreement on what HSI is and how each service should implement it in the Acquisition Framework.

In 2008, the 2003 version of DoDI 5000.2 was replaced with DoDI 5000.02. The new 2008 version is similar to the 2003 version, requiring the PM to optimize total system performance and minimize the Life Cycle cost of ownership through a "total system approach" to acquisition management. Government contractors know that HSI is a contractual requirement that must be completed during the design and development phases of the acquisition process (Integrated Framework chart, 2005). Usually, HSI is initially addressed as a program plan in the Joint Capabilities Integration Development System (JCIDS) process. However, its importance extends beyond Milestone B. After Milestone B, HSI builds the foundation of the materiel solution required to be in the program plan. If a materiel solution is not identified in JCIDS, the Life Cycle ends and HSI is not implemented throughout the remainder of the doctrine, organization, training, materiel, leadership and education, personnel and facilities (DOTMLPF). Hence, DoDI 5000.02 does not address the entire Life Cycle in the document; HSI is also not addressed, leaving little or no consideration to the total Life Cycle cost of the program. Current service policy addressing HSI is limited and differs among the services. The vague wording of many of these documents indicates that HSI needs to be done; however, it does not provide criteria or guidelines for how to conduct HSI throughout the Life Cycle. This lack of information is why it is important that a comprehensive joint acquisition policy, which addresses HSI throughout the Life Cycle, be created and implemented. This thesis makes recommendations for a joint framework for a new comprehensive policy throughout the IDAT&L Life Cycle Management Process.

C. RESEARCH OBJECTIVES

The objectives of this thesis are to:

- Conduct a comparative analysis of current HSI policies and procedures utilized by the Navy.
- Identify the significant gaps in guidelines and policies in service documentation and implementation.
- Propose strengthened policy, based on the information and knowledge gathered from the current framework and gaps, to improve the efficiency and effectiveness of the acquisition process.

D. RESEARCH QUESTIONS

This thesis poses the question: What modifications can be made within the Navy, and the acquisition process as a whole, to better address and improve the application of HSI in the Acquisition, Technology and Logistics (AT&L) framework?

In addressing the question above, the following questions were also considered:

- What are the objectives of DoDD 5000.02 with respect to HSI requirements for the U.S. Navy?
- What policies, procedures, and infrastructures currently exist within the U.S. Navy to carry out HSI?
- What gaps exist between the current policies, procedures, and infrastructure?
- If gaps do exist, how can these gaps be closed?

E. METHODOLOGY

This thesis analyzes how the U.S. Navy integrates human considerations and HSI into the IDAT&L Framework. Generalizations regarding the entire HSI program for the U.S. Navy are based on the details of the analysis of instruction and policy that have been published. This thesis critically evaluates U.S. Navy policy and guidance for conducting HSI and recommends proposed solutions to fill gaps in the policy.

This thesis first establishes a baseline of HSI requirements among all Navy acquisition programs as outlined in the Department of Defense Directive (DoDD) 5000.02. This baseline is used to establish a way in which HSI programs and policy are evaluated. Additionally, this thesis identifies gaps in all documents that need to be addressed in order to have coherent HSI policy and guidance. These gaps, found through document review and structured interviews, are later used to recommend revisions to DoD policy and to establish a joint framework for conducting HSI throughout the entire Life Cycle of a program.

Based on the results of the analysis, this thesis recommends revisions to HSI policy that seek to reduce Life Cycle cost, improve total system performance, and enhance quality of life for the end users, namely the Sailors and Marines who are defending this country on a daily basis and who will ultimately reap the benefits of this work. Those who make decisions throughout the DoD systems will be better informed, will understand how to mitigate Life Cycle costs, and will begin to recognize the human as a critical factor in any system throughout the entire Life Cycle process. The benefits may be difficult to measure at first, but over time there will be a greater understanding of HSI, which will lead to a better understanding of the trade-offs that occur whenever a system is developed.

The information presented in this thesis was gathered from a literature review of other texts, periodicals, directives, articles, and regulations pertaining to HSI in the DoD acquisition process.

F. SCOPE AND LIMITATIONS

This thesis assumes that the reader understands the basic principles and current policies governing DoD systems acquisition and program management, as well as DoD and Navy organizations involved therein. Further, it assumes that the reader has a limited knowledge of HSI and will therefore explain HSI concepts and procedures in detail. This thesis focuses on the implementation of HSI through a materiel solutions approach. It is important to understand that HSI is also critical to the process of implementing a nonmateriel approach and solution through the use of DOTMLPF; however, nonmateriel approaches are not within the scope of this thesis.

G. ORGANIZATION

The remainder of the thesis is organized as follows: Chapter II provides the approach used to determine the effectiveness of current policy and how gaps are identified. Chapter III describes a model created to serve as the ideal case, i.e., a way in which DoD HSI policy could be comprehensive and complete. This model serves as the goal for future DoD HSI policy and guidance, from which analysis and recommendations are taken. Chapter IV identifies and describes the gaps found between current policy and our ideal model for this level of documentation. Chapter V proposes recommendations based on the gap analysis to improve the HSI policy within the U.S. Navy. Chapter VI summarizes the conclusions derived from the document analysis as well as the new framework recommendations.

II. APPROACH

A. DESIGN

In order to conduct a gap analysis of the current documentation pertaining to HSI within the U.S. Navy, we first propose an ideal conceptual model, which is explained in detail in Chapter III. This model is used to measure the effectiveness of the current HSI policy and to identify the gaps within the policy. This approach does not involve studying individuals, but instead relies on analytical thought and critiques of current DoD policy and guidance. The documents chosen for analysis were:

- DoDD 5000.1 (2003)
- DoDI 5000.02 (2008)
- CHAIRMAN OF THE JOINT CHIEFS OF STAFF INSTRUCTION (CJCSI) 3170.01F (2007)
- OFFICE OF THE CHIEF OF NAVAL OPERATIONS INSTRUCTION (OPNAVINST) 5310.23 (2008)
- SECRETARY OF THE NAVY INSTRUCTION (SECNAVINST) 5000.2D (2008)
- VIRTUAL SYSCOM (VS) HSI GUIDE VOLUME I (2005)
- VS HSI GUIDE VOLUME II (2005)
- NAVAL SEA SYSTEMS COMMAND HUMAN SYSTEMS ENGINEERING (NAVSEA HSE) CODE OF BEST PRACTICES (2008)

B. DESCRIPTION OF IDEAL MODEL

Microsoft Visio was used to construct a visual representation of the ideal model. A system engineering/JCIDS approach was used to create a functional needs analysis to break down each component from the highest to the lowest possible level. Each separate item in the model was deemed important to HSI, based on the IDAT&L Life Cycle Management Framework. In order to be less biased, current policy and guidance was not used when creating this model, which serves as an ideal model, without reference to current policy.

C. HYPOTHESIS

There are significant gaps in documentation of HSI policy and guidance at all levels throughout the Department of the Navy (DoN).

D. PROCEDURE

Each reference (policies, guidance, etc.) used in this thesis was assigned a priority level, based on the hierarchical structure of the U.S. Navy. This priority level has associated elements within the model that should be incorporated in the documentation at that level. In order to identify the gaps, each document was read closely and analyzed as it currently stands, looking for the associated elements that should be contained in it according to the ideal model. The elements not contained within the document were identified as gaps. After all documents were analyzed individually, three tracks were created pertaining to the three major U.S. Navy Systems Commands (SYSCOMs): Naval Sea Systems Command (NAVSEA), Naval Air Systems Command (NAVAIR), and Space and Naval Warfare Systems Command (SPAWAR). Each of these tracks began at the highest level, the DoD, and ended at the specified SYSCOM. This allowed us to not only identify gaps within individual documents, but also to identify gaps as a whole within the Navy's acquisition structure. Recommendations were made for filling each gap within the parameters of the current references as well as within each SYSCOM track.

III. IDEAL MODEL

A. BACKGROUND ON THE IDEAL MODEL

This chapter explains the methodology used in creating our ideal model for HSI policy throughout the U.S. Navy. It enables the reader to follow the systematic approach taken to analyze HSI policy and guidance that exists in the DoN. This ideal model was created based on the existing Integrated Architecture (IA) and existing policy and guidance, and drew on our knowledge and understanding of the HSI process. The existing IA was created by numerous individuals from the U.S. Navy's HSI Virtual Systems Command (VSYSCOM). We have amended portions of the IA to implement the policy that plays an important role in HSI throughout the Navy.

In conjunction with the IA, members of the U.S. Navy Virtual SYSCOM use a program called the Human Analysis and Requirements Planning System (HARPS), which is a tool that allows the identification of automation through development of the HSI IA. The IA is embedded in HARPS and, by using the IA as the basis for the ideal model, by default HARPS is incorporated in the model.

Policy is the basis for all tasks in the Navy. It mandates the tasks that *should be done*, without explicitly stating *how* they are to be done. Policy creates a common baseline to guide the SYSCOM through complex undertakings. To effectively mandate a specific task, it should be fully specified throughout all levels of authority. In the absence of appropriate policy, breakdowns may occur regarding specific requirements to accomplish the necessary goal. These breakdowns can have significant effects, especially if policy at the highest levels is lacking or unclear. Due to this potential shortcoming, policy is a large part of this ideal model, and results in our model differing substantially from the IA. Our focus on policy allows us to analyze gaps in the IDAT&L Life Cycle Management Framework as well as the policies pertaining to HSI.

The IA was developed to provide the SYSCOMs with guidance in the application of HSI, and is complex and detailed in nature. Our ideal model is based on the current IA, but is specifically designed to analyze the full range of policy covered by the DoD. We do not suggest that the ideal model optimizes HSI. Rather, it provides a comprehensive coverage that ensures that HSI is being fully implemented at all levels.

B. PURPOSE

The objective of creating this ideal model is to provide an overview of HSI policy that allows HSI practitioners the ability to recognize shortcomings in current policies and guidance. The end goal of HSI is to integrate the human into all aspects of the system design and acquisition process. It focuses on human performance and trade-offs, given the specifications of each individual system. These short-comings are referred to as gaps, and their identification allows policy makers to see where changes need to be made in the existing policy to ensure HSI is being performed efficiently and that the appropriate people are involved in its delivery.

C. STRUCTURE OF MODEL

This section describes the ideal model in a systematic manner. The ideal model, and a brief explanation of each item, is seen in Figure 1. In order to create a mental picture for the reader, we have condensed the model onto one page. In the Appendix, the complete model is laid out on multiple pages to allow the reader the ability to read the text of the model.

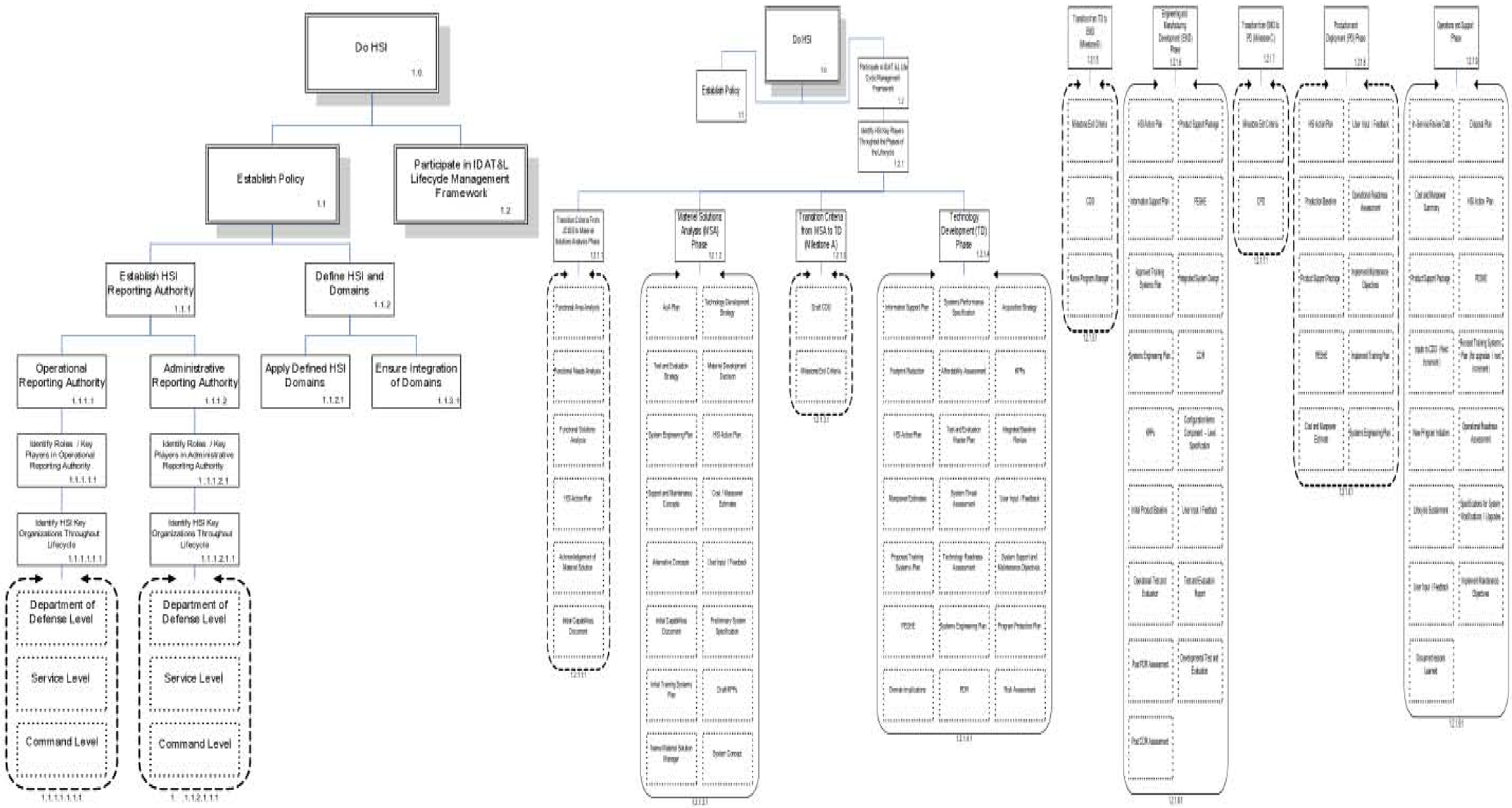

Figure 1. The Ideal Model

1\. – **Do HSI**

"The process of conducting Human Systems Integration is intended to integrate human-related issues into the development of the product by identifying specific human-related and mission-related performance and system design requirements, communicating those requirements throughout the design process, and ensuring those requirements are met" (Virtual SYSCOM (VS), Vol. 2, 2005, p. 12).

1.1 – **Establish Policy**

A planned course of action that sets forth guiding principles and procedures for ensuring HSI is properly embedded throughout the entire acquisition strategy, to produce the most advantageous products to the user, at the lowest possible cost.

1.1.1 – **Establish HSI Reporting Authority**

A structure created to ensure an open line of communication throughout all organizations in HSI and the Acquisition Framework, from top to bottom, to effectively track and report all HSI-relevant areas and provide oversight for successful program acquisition.

1.1.1.1 – **Operational Reporting Authority**

The Operational Reporting Authority is tasked with "the employment of the forces provided by the administrative chain of command, in order to carry out missions in support of the National Defense" (Naval Officers Guide, 1998, p. 185). Since an Operational Reporting Authority already exists in the Navy, HSI practitioners shall be embedded at all levels throughout the reporting authority to ensure open lines of communication and provide oversight in a successful program acquisition.

1.1.1.1.1 – **Identify Roles/Key Players in Operational Reporting Authority**

Job title and description for key players serve as part of the operational reporting authority. In addition to meeting the requirements for the specific job description, these key personnel must also be HSI practioners with documented education and experience.

1.1.1.1.1.1 – **Identify HSI Key Organizations Throughout the Life Cycle**

Organizations throughout the DoD and DoN are responsible for implementing and overseeing the HSI process at various stages throughout the IDAT&L Life Cycle. These HSI organizations exist within larger organizations that are stakeholders in the acquisition process.

1.1.1.1.1.1.1

- **DoD Level**

  Refers to DoD and Chairman of the Joint Chiefs of Staff (CJCS) offices.

- **Service Level**

  Refers to the Office of the Chief of Naval Operations (OPNAV) and the Office of the Secretary of the Navy (SECNAV) as well as VSYSCOM.

- **Command Level**

  Refers to the System Commands (NAVSEA, NAVAIR, and SPAWAR).

1.1.1.2 – **Administrative Reporting Authority**

The administrative chain of command is tasked with manning, training, and equipping forces. Since an Administrative Reporting Authority already exists in the Navy, HSI practitioners shall be imbedded at all levels throughout the reporting authority to ensure open lines of communication and provide oversight in a successful program acquisition.

1.1.1.2.1 – **Identify Roles/Key Players in the Administrative Reporting Authority**

Identifies the job title and description for key players that serve as part of the Administrative Reporting Authority. In addition to meeting the requirements for the specific job description, these key personnel must also be HSI practioners, with documented education and experience.

1.1.1.2.1.1 – **Identify HSI Key Organizations Throughout the Life Cycle**

Organizations throughout the DoD and DoN that are responsible for implementing and overseeing the HSI process at various stages throughout the IDAT&L Life Cycle. These HSI organizations exist within larger organizations that are stakeholders in the acquisition process.

1.1.1.2.1.1.1

- **DoD Level**

  Refers to DoD and CJCS offices.

- **Service Level**

  Refers to OPNAV and SECNAV as well as VSYSCOM.

- **Command Level**

  Refers to the System Commands (NAVSEA, NAVAIR, and SPAWAR).

1.1.2 – **Define HSI and Domains**

"HSI acknowledges that the human is a critical component of any complex system. It is an interdisciplinary approach that makes explicit the underlining tradeoffs across the HSI domains, facilitating optimization of total system performance" (Miller & Shattuck, 2006, p. 4). The domains of HSI are: Manpower, Personnel, Training, Human Factors Engineering, Survivability, Habitability, Environment, Safety, and Occupational Health.

1.1.2.1 – **Apply Defined HSI Domains**

Incorporate all HSI domains listed above to effectively optimize total system performance. Application of all domains will allow for complete trade-off analysis.

1.1.3.1 – **Ensure Integration of Domains**

"Identify desirable and practical alternatives among requirements, technical objectives, design, program schedule, functional and performance requirements and Life Cycle costs to optimize human performance" (VS, Vol. 2, 2005, p. 14).

1.2 **– Participate in IDAT&L Life Cycle Management Framework**

Actively engage in all prescribed portions of the framework, from beginning to end, to ensure HSI is integrated throughout the entire framework.

1.2.1 **– Identify HSI Key Players Throughout the Life Cycles' Phases**

Identify personnel throughout the DoD and DoN that are responsible for implementing and guiding the HSI process at various stages throughout the IDAT&L Life Cycle. These HSI personnel are members of a stakeholder command in the acquisition process.

1.2.1.1 **– Transition Criteria from JCIDS to the Materiel Solutions Analysis Phase**

"Entry point to begin translating the HSI requirements established in JCIDS into materiel solutions phase by balancing technology opportunities, schedule constraints, funding availability, performance parameters, and operational requirements" (VS, Vol. 2, 2005, p. 16).

1.2.1.1.1 **– Subset of 1.2.1.1**

Functional Area Analysis

"Identifies the mission area or mission problem to be assessed, the concepts to be examined, the timeframe in which the problem is being assessed, and the scope of the assessment, and describes the relevant objectives and concept of operations (CONOPs) or concepts and the relevant effects to be generated" (Defense Acquisition University (**DAU), 2005, p. B-66)**

Functional Needs Analysis

"Assesses the ability of the current and programmed war fighting systems to deliver the capabilities of the Functional Area Analysis identified under the full range of operating conditions and to the designated measures of effectiveness. The FNA produces a list of capability gaps that requires solutions and indicates the time frame in which those solutions are needed. It may also identify redundancies in capabilities that reflect inefficiencies" (**DAU, 2005, p. B-67)**

Functional Solutions Analysis

"Operationally assess all potential doctrine, organization, training, materiel, leadership and education, personnel and facilities (DOTMLPF), approaches to solving (or mitigating) the capability gaps (needs) identified in the Functional Needs Analysis (FNA), highlighting human systems impacts" (VS, Vol. 2, 2005, p. 14).

HSI Action Plan

"Document plans to implement HSI within the acquisition process, emphasizing customer involvement, definition of processes for implementing, integration of all HSI domains, acquisition activities, work plans, and resources" (VS, Vol. 2, 2005, p. 18). This will not be a stand-alone document; it will be integrated with the systems engineering plan(s).

Acknowledgement of Materiel Solution

"Identify the HSI domain impacts of the proposed materiel solutions" (VS, Vol. 2, 2005, p. 15).

Initial Capabilities Document

"Generate the HSI inputs for the ICD and review the overall HSI inclusion and integration" (VS, Vol. 2, 2005, p. 16).

1.2.1.2 **– Materiel Solutions Analysis Phase (MSA)**

"The purpose of this phase is to assess potential materiel solutions and to satisfy the phase-specific entrance criteria for the next program milestone designated by the MDA" (DoD, 2008, p. 14).

1.2.1.2.1 **–** Subset of 1.2.1.2

Analysis of Alternatives (AoA) Plan

"Perform HSI assessment of advantages and disadvantages of alternatives being considered to satisfy capabilities, including a sensitivity of each alternative to possible changes in key assumptions or variables. These assessments should be considered in selection of the preferred materiel solution" (VS, Vol. 2, 2005, p. 19).

Technology Development Strategy

“Assure Request for Proposal (RFP) includes HSI domain and integration requirements within the Statement of Work (SOW), Specification and Contract Data Requirements. Review and evaluate contractor response to RFP for HSI considerations to approach, cost estimate, and resources” (VS, Vol. 2, 2005, p. 23).

Test and Evaluation Strategy

This is a document “that describes risk reduction efforts across the range of activities that will ultimately produce a valid evaluation of operational effectiveness, suitability, and survivability before full-rate production and deployment” (DAU, 2004, p. 477).

Materiel Development Decision

This allows a program to enter into the Acquisition Framework/system. It is a mandatory decision point that is developed from the initial capabilities document (ICD), as well as all preliminary concepts, needs, and capabilities, and allows optimal trade-offs to be performed.

System Engineering Plan

This is a “program’s overall technical approach including the systems engineering process; resources; and key technical tasks, activities, and events along with their metrics and success criteria. Integration and linkage with other program management control efforts is fundamental to successful application. This plan must address the who, what, when, where, why and how of the applied system” (DAU, 2004, p. 166).

HSI Action Plan

“Document plans to implement HSI within the acquisition process emphasizing customer involvement, definition of processes for implementing, integration of all HSI domains, acquisition activities, work plans, and resources. Additionally, this includes the aggregation of all inputs available at this stage of the program to ensure that all HSI needs and constraints of the concept definition are completely captured and managed as an integrated whole, and that all of the HSI needs and constraints can be met by each of the concept alternatives under consideration”

(VS, Vol. 2, 2005, p. 18). This will not be a stand-alone document; it will be integrated with the systems engineering plan(s).

Support and Maintenance Concepts

"[Support and] maintenance considerations, constraints, and plans for operational support of the system/equipment under development" (**DAU, 2005, p. B-97)**

Cost and Manpower Estimates

"The estimate of dollars and personnel required to operate, maintain, support, and provide system-related training, in advance of the approval of the development, or production and deployment of the system. These estimates should be consistent with manpower levels assumed in the affordability assessment and cost requirements" (DAU, 2004, p. 52).

Alternative Concepts

"Identify desirable and practical alternatives among requirements, technical objectives, design, program schedule, functional and performance requirements and Life Cycle cost to optimize human performance" (VS, Vol. 2, 2005, p. 14).

User Input/Feedback

The user needs to provide their needs and constraints to the manufacturer in order to keep the program aligned with the initial demand of the user.

Initial Capabilities Document

"Generate the HSI inputs for the ICD and review the overall HSI inclusion and integration" (VS, Vol. 2, 2005, p. 16).

Preliminary System Specification

"States the [initial] system level functional and performance requirements, interfaces, adaptation requirements, security and privacy requirements, computer resource requirements, design constraints (including software architecture, data standards, programming language), software support and precedence requirements, and developmental test requirements for a given system" (**DAU, 2005, p. B-161)**

Initial Training Systems Plan

"Develop a training/instructional system that should be employed by transformational training concepts, strategies, and tools such as computer based and interactive courseware, simulators, and embedded training consistent with strategy, goals and objectives of the proposed system" (DAU, 2004, p. 253).

Draft Key Performance Parameters (KPPs)

"[Draft] attributes or characteristics of a system that are considered critical or essential to the development of an effective military capability and those attributes that make a significant contribution to the key characteristics as defined in the Joint Operations Concept [especially in the HSI domains]" (**DAU, 2005, p. B-91)**

Name Materiel Solution Manager

Materiel Solution Manager "is responsible for managing the HSI related program requirements from concept to disposal, bringing together all stake holders and involving industry (except during competition phases) under their leadership and must be able to balance trade-offs between performance, cost and time within boundaries set by the approving authority" (VS, Vol. 2, 2005, p. 17).

System Concept

"A formal document that describes the intended purpose, employment, deployment, and support of a system" (**DAU, 2005, p. B-161)**

1.2.1.3 **– Transition Criteria from Material Solutions Analysis (MSA) to Technology Development (TD) (Milestone A)**

Transition between phases is delineated by requirements that must be met before entrance to the next phase.

1.2.1.3.1 **–** Subset of 1.2.1.3

Draft Capability Development Document (CDD)

"A [draft] document that captures the information necessary to develop a proposed program [throughout the Life Cycle]. The CDD outlines an affordable increment of militarily useful, logistically supportable, and technically mature capability" (CJCSI 3170.01G, 2009, GL-5).

Milestone Exit Criteria

"The point at which a recommendation is made and approval sought regarding starting or continuing an acquisition program, i.e., proceeding to the next phase"

(**DAU, 2005, p. B-104).** The purpose is to establish (at the beginning of each phase) what criteria must be met to exit that phase.

1.2.1.4 **– Technology Development (TD) Phase**

"This phase reduced technology risk and determines the appropriate set of technologies to be integrated into a full system. Technology development is a continuous technology discovery and development process that reflects close collaboration between the science and technology community, the user, and the developer. Technology development is an iterative process of assessing technologies and refining user performance parameters" (VS, Vol. 2, 2005, p. 22).

1.2.1.4.1 **–** Subset of 1.2.1.4

Information Support Plan (ISP)

"The ISP contains interface descriptions, infrastructure and support requirements, standards profiles, measures of performance, and interoperability shortfalls" (**DAU, 2005, p. B-79)**

Systems Performance Specification

A plan that delineates the specifications required by the user for a successful completion. These specifications include, but are not limited to, test methods, performance testing requirements, safety considerations and requirements, environmental considerations and requirements, as well as quality and completion requirements.

Acquisition Strategy

"A business and technical management approach designed to achieve program objectives within the resource constraints imposed. It is the framework for planning, directing, contracting for, and managing a program. It provides a master schedule for research, development, test, production, fielding, modification, postproduction management, and other activities essential for program success. The acquisition strategy is the basis for formulating functional plans and strategies" (**DAU, 2005, p. B-4)**

Footprint Reduction

Reduce footprints through the use of alternative concepts/solutions to mitigate the negative effects of a particular footprint.

Affordability Assessment

“[An assessment generating a] determination of the Life Cycle Cost of an acquisition program in consonance with the long-range investment and force structure plans of the DoD or individual DoD Components” (**DAU, 2005, p. B-7)**

KPPs

“Attributes or characteristics of a system that are considered critical or essential to the development of an effective military capability and those attributes that make a significant contribution to the key characteristics as defined in the Joint Operations Concept [especially in the HSI domains]” (**DAU, 2005, pg. B-91)**

HSI Action Plan

“Document plans to implement HSI within the acquisition process emphasizing customer involvement, definition of processes for implementing, integration of all HSI domains, acquisition activities, work plans, and resources” (VS, Vol. 2, 2005, p. 18). This will not be a stand-alone document; it will be integrated with the systems engineering plan(s).

Test and Evaluation (T&E) Master Plan

“Documents the overall structure and objectives of the Test and Evaluation (T&E) program. It provides a framework within which to generate detailed T&E plans and it documents schedule and resource implications associated with the T&E program. The TEMP identifies the necessary Developmental Test and Evaluation (DT&E), Operational Test and Evaluation (OT&E), and Live Fire Test and Evaluation (LFT&E) activities. It relates program schedule, test management strategy and structure, and required resources to: Critical Operational Issues (COIs), Critical Technical Parameters (CTPs), objectives and thresholds documented in the Capability Development Document (CDD), evaluation criteria, and milestone decision points” (**DAU, 2005, B-166).**

Integrated Baseline Review

"Review of the Performance Measurement Baseline used to determine compliance and integration of domain related topics throughout the system" (**DAU, 2005, p.B-82).**

Manpower Estimates

"The estimate of personnel required to operate, maintain, support, and provide system-related training, in advance of the approval of the development, or production and deployment of the system. These estimates should be consistent with manpower levels assumed in the affordability assessment and cost requirements" (DAU, 2004, p. 68).

System Threat Assessment

Assessment made to summarize "significant changes in the threat environment as well as a discussion of the operational threat environment, adversary capability(s) [sic] that may affect operation of the system, system specific threat, reactive threat, and technologically feasible threats" (DAU, 2004, p. 392).

User Input/Feedback

The user needs to provide their needs and constraints to the manufacturer in order to keep the program aligned with the initial demand of the user.

Proposed Training Systems Plan

"Document and update the initial "training/instructional system that should be employed by transformational training concepts, strategies, and tools such as computer based and interactive courseware, simulators, and embedded training consistent with strategy, goals and objectives of the proposed system" (DAU, 2004, p. 253).

Technology Readiness Assessment

"The system components are substantiated (e.g., through analyses, modeling and simulation, demonstrations, etc.) to allow verification of the components into an overall system for further validation" (VS, Vol. 2, 2005, p. 27).

System Support and Maintenance Objectives

"[Support and] maintenance considerations, constraints, and plans for operational support of the system/equipment under development" (**DAU, 2005, p. B-97).**

Programmatic Environment, Safety, and Health Evaluation (PESHE)

Develop design options and specific design requirements to satisfy requirements in the areas of Environment, Safety, and Occupational Health.

Systems Engineering Plan

"This is a program's overall technical approach including the systems engineering process; resources; and key technical tasks, activities, and events along with their metrics and success criteria. Integration and linkage with other program management control efforts is fundamental to successful application. This plan must address the who, what, when, where, why and how of the applied system" (DAU, 2004, p. 80).

Program Protection Plan

"[A plan set forth to] safeguard defense systems and Technical Data (TD) anywhere in the acquisition process, to include the technologies being developed, the support systems, [within military and HSI applications]" (**DAU, 2005, p. B-133).**

Domain Implications

Specific side effects of domain integration and trade-offs throughout the system. By incorporating domain integration, a hierarchy of priorities must be established to optimize the system through conducting the necessary trade-offs.

Preliminary Design Review (PDR)

The PDR will inform requirement trades; improve cost estimation; and indentify remaining design, integration, and manufacturing risk. The PDR shall be conducted at the system level and include user representatives (DoD, 2008).

Risk Assessment

"Identification and analysis of potential cost and risk to the program plan. The risk assessment should include but not be limited to cost, performance, and schedule" (VS, Vol. 2, 2005, p. 28).

1.2.1.5 – **Transition From TD to Engineering and Manufacturing Development (EMD) (Milestone B)**

Transition between phases is delineated by requirements that must be met before entrance to the next phase.

1.2.1.5.1 **–** Subset of 1.2.1.5

Milestone Exit Criteria

"The point at which a recommendation is made and approval sought regarding starting or continuing an acquisition program, i.e., proceeding to the next phase" (**DAU, 2005, p. B-104).** The purpose is to establish (at the beginning of each phase) what criteria must be met to exit that phase.

CDD

"Primary means of defining authoritative, measurable, and testable capabilities needed by the war fighters to support the EMD phase" (DAU, 2004, p. 220). The CDD focuses on affordability, reliability, and supportability.

Name PM

Identify and establish a PM to effectively work with the Materiel Solution Manager in order to ensure the continuity of the work previously done, as well as maintain effective use of HSI domain practitioners throughout the rest of the Life Cycle.

1.2.1.6 **– EMD Phase**

"The initial HSI activity in this phase is to develop human-centered design concepts in the context of alternative system design concepts. HSI concepts include human-machine interfaces, human-computer interface (HCI), workstations, procedures/documentation/decision aiding, work space/facility, maintainability design, safety and health hazard avoidance design and training systems design. The purposed of EMD is to develop a system; reduce integration and manufacturing risk; ensure operationally supportability with particular attention to reducing the logistics footprint; implement HSI; design for product ability; ensure affordability and protection of Critical Program Information (CPI); and demonstrate system integration, interoperability, safety, and utility" (VS, Vol. 2, 2005, p. 29).

1.2.1.6.1 – Subset of 1.2.1.6

HSI Action Plan

"Document plans to implement HSI within the acquisition process emphasizing customer involvement, definition of processes for implementing, integration of all HSI domains, acquisition activities, work plans, and resources" (VS, Vol. 2, 2005, p. 18). This will not be a stand-alone document; it will be integrated with the systems engineering plan(s).

Product Support Package

"Identify the activities, resources, schedule and critical integration requirements for the current phase" (VS, Vol. 2, 2005, p. 31).

ISP

"The ISP contains interface descriptions, infrastructure and support requirements, standards profiles, measures of performance, and interoperability shortfalls" (**DAU, 2005, p. B-79)**

PESHE

Develop design options and specific design requirements to satisfy requirements in the areas of Environment, Safety, and Occupational Health.

Integrated System Design

Combine all inputs available at this stage of the program to ensure that all HSI needs and constraints of the concept are completely captured and managed as an integrated whole, and that all of the HSI needs and constraints can be met by each of the concept alternatives under consideration.

Approved Training Systems Plan

Finalize the "training/instructional system that should be employed by transformational training concepts, strategies, and tools such as computer based and interactive courseware, simulators, and embedded training consistent with strategy, goals and objectives of the proposed system" (DAU, 2004, p. 253).

Critical Design Review (CDR)

"A multi-disciplined technical review to ensure that a system can proceed into fabrication, demonstration, and test and can meet stated performance requirements within cost, schedule, risk, and other system constraints. Generally this review assesses the system final design as captured in product specifications for each configuration item in the system's product baseline, and ensures that each configuration item in the product baseline has been captured in the detailed design documentation" (DAU, 2004, p. 127).

Systems Engineering Plan

"This is a program's overall technical approach including the systems engineering process; resources; and key technical tasks, activities, and events along with their metrics and success criteria. Integration and linkage with other program management control efforts is fundamental to successful application. This plan must address the who, what, when, where, why and how of the applied system" (DAU, 2004, p. 80).

Configuration Items Component-Level Specification

"Comprehensive and iterative processes to convert each required capability into a system performance specification; translate user-defined performance parameters into configured systems; integrate the technical inputs of the entire design system; transition technology from the technology based into program specific efforts; and verify that designs meet operational needs" (VS, Vol. 2, 2005, p. 31).

Key Performance Parameters (KPPs)

"Attributes or characteristics of a system that are considered critical or essential to the development of an effective military capability and those attributes that make a significant contribution to the key characteristics as defined in the Joint Operations Concept [especially in the HSI and/or HSI domains]" (DAU, 2005, p. B-91)

User Input/Feedback

The user needs to provide their needs and constraints to the manufacturer in order to keep the program aligned with the initial demand of the user.

Initial Product Baseline

"Construct or assemble hardware and software components and material to support human components, specified by the system design and maintenance concept" (VS, Vol. 2, 2005, p. 43).

T&E Report

A report of the findings found during T&E, specifically citing HSI domains and human interactions as found through the Operational and Developmental Test and Evolution events.

OT&E

"Through [Operational] Test and Evaluation events and other activities verify and validate, the design solutions relating to the entire system, but specifically highlighting HSI domains that satisfy requirements. Perform evaluations at the total system level, demonstrating performance in the expected operational environment. Operational environment includes operational supportability and interoperability" (VS, Vol. 2, 2005, p. 35).

DT&E

"Through [Developmental] Test and Evaluation events and other activities, verify and validate, the design solutions relating to HSI domains to satisfy requirements" (VS, Vol. 2, 2005, p. 35).

Post-PDR Assessment

Assessment conducted by the PM and Milestone Decision Authority to ensure that the PDR report reflects any requirements trades based on the assessment of cost, schedule, and performance risk (DoD, 2008).

Post-CDR Assessment

Assessment considers whether, based on the PM's report, the program is able to provide capability consistent with the acquisition baseline approved at Milestone B (DoD, 2008).

1.2.1.7 **– Transition from EMD to PD (Milestone C)**

Transition between phases is delineated by requirements that must be met before entrance to the next phase.

1.2.1.7.1 – Subset of 1.2.1.7

Milestone Exit Criteria

"Conduct documentation reviews and other activities to complete approval and publication of program documentation" (VS, Vol. 2, 2005, p. 36). The purpose is to establish (at the beginning of each phase) what criteria must be met to exit that phase.

CPD

"Document contains refined/desired operational capabilities and expected system performance that are used throughout the test and evaluation phase. These inputs are used to update the Test and Evaluation Master Plan for the Milestone C decision and subsequent updates later in production and deployment. [This document] focuses on evaluation of the systems' operational effectiveness, suitability, and survivability" (DAU, 2004, p. 431).

1.2.1.8 **– Production and Deployment (PD) Phase**

"The system is produced and fielded, continually undergoing test and evaluation to ensure that it is being implemented as designed and that the design will meet mission requirements. During the Production and Deployment Phase, the system should achieve operational capability that satisfies mission needs. During this phase the production and deployment team is responsible for managing the HSI related program requirements from concept to disposal, bringing together all stakeholders and Industry to balance tradeoffs between performances, cost and time" (VS, Vol. 2, 2005, p. 37).

1.2.1.8 .1 – Subset of 1.2.1.8

HSI Action Plan

"Document plans to implement HSI within the acquisition process emphasizing customer involvement, definition of processes for implementing, integration of all HSI domains, acquisition activities, work plans, and resources. This will be a stand alone document" (VS, Vol. 2, 2005, p. 18).

User Input/Feedback

The user needs to provide their needs and constraints to the manufacturer in order to keep the program aligned with the initial demand of the user.

Production Baseline

“The document which describes the [baseline] for employment of the manufacturing resources to produce the required products or systems, on time, and within cost constraints” (**DAU, 2005, p. B-127).**

Operational Readiness Assessment

“Evaluate prototypes, early production versions of the system, and training capabilities to identify areas in which performance of the fielded version may not be satisfactory. Review other evaluations of the system, preliminary user feedback, and training feedback to determine other possible shortcomings or other specific areas in which performance, effectiveness, or efficiency may be improved” (VS, Vol. 2, 2005, p. 39).

Product Support Package

“Identify the activities, resources, schedule and critical integration requirements for the current phase” (VS, Vol. 2, 2005, p. 41).

Implement Maintenance Objectives

“[Implement] maintenance considerations, constraints, and plans for operational support of the system/equipment under development” (**DAU, 2005, p. B-97).**

PESHE

Revise and develop design options and specific design requirements to satisfy requirements in the areas of Environment, Safety, and Occupational Health.

Implement Training Plan

Deploy/field “training/instructional system that should be employed by transformational training concepts, strategies, and tools such as computer based and interactive courseware, simulators, and embedded training consistent with strategy, goals and objectives of the proposed system” (DAU, 2004, p. 253).

Cost and Manpower Estimate

"The estimate of dollars and personnel required to operate, maintain, support, and provide system-related training, in advance of the approval of the development, or production and deployment of the system. These estimates should be consistent with manpower levels assumed in the affordability assessment and cost requirements" (DAU, 2004, p. 52).

Systems Engineering Plan

"This is a program's overall technical approach including the systems engineering process; resources; and key technical tasks, activities, and events along with their metrics and success criteria. Integration and linkage with other program management control efforts is fundamental to successful application. This plan must address the who, what, when, where, why and how of the applied system" (DAU, 2004, p. 80).

1.2.1.9 – **Operations and Support Phase**

"Operations and support includes the activities necessary to sustain the system—including training, maintenance, modernization, and upgrades - in a cost-effective manner throughout the Life Cycle. The operations and support team is responsible for managing HSI related program requirements from concept to disposal, bringing together all stakeholders and Industry to balance tradeoff between performance, cost, and time" (VS, Vol. 2, 2005, p. 40).

1.2.1.9.1 – Subset of 1.2.1.9

In-Service Review Data

"Review existing data; participate in external - ongoing data collection activities; conduct focused human performance assessments; a model should include an issue repository that should be reviewable and accessible by all stakeholders" (VS, Vol. 2, 2005, p. 42).

Disposal Plan

A plan that guides the demilitarization process and disposal in "accordance with all legal and regulatory requirements and policy relating to safety (including explosive safety), security, and the environment" (DoD, 2008, p. 29).

Cost and Manpower Summary

"The [actual number] of dollars and personnel required to operate, maintain, support, and provide system-related training, in advance of the approval of the development, or production and deployment of the system. These [numbers] should be consistent with manpower levels assumed in the estimates, affordability assessment and cost requirements" (DAU, 2004, p. 52).

HSI Action Plan

"Document plans to implement HSI within the acquisition process emphasizing customer involvement, definition of processes for implementing, integration of all HSI domains, acquisition activities, work plans, and resources. This will be a stand-alone document" (VS, Vol. 2, 2005, p. 18).

Product Support Package

"Identify the activities, resources, schedule and critical integration requirements for the current phase" (VS, Vol. 2, 2005, p. 17).

PESHE

Revise and develop design options and specific design requirements to satisfy requirements in the areas of Environment, Safety, and Occupational Health.

Inputs to CDD (Next Increment)

"Primary means of defining authoritative, measurable, and testable capabilities needed by the war fighters to support the EMD phase" (DAU, 2004, p. 220). The CDD focuses on affordability, reliability, and supportability.

Revised Training Systems Plan (For Upgrades/Next Increment)

Document and update the "training/instructional system that should be employed by transformational training concepts, strategies, and tools such as computer based and interactive courseware, simulators, and embedded training consistent with strategy, goals and objectives of the proposed system" (DAU, 2004, p. 253).

New Program Initiation

Appropriate Life Cycle support organization designs and developments a detailed solution to address [new program initiatives].

Operation Readiness Assessment

"Evaluate prototypes, early production versions of the system, and training capabilities to identify areas in which performance of the fielded version may not be satisfactory. Review other evaluations of the system, preliminary user feedback, and training feedback to determine other possible shortcomings or other specific areas in which performance, effectiveness, or efficiency may be improved" (VS, Vol. 2, 2005, p. 39).

Life Cycle Sustainment

"Life Cycle sustainment planning and execution seamlessly span a system's entire Life Cycle, from materiel solution analysis to disposal. It translates force provider capability and performance requirements into tailored product support to achieve specified and evolving Life Cycle product support availability, reliability, and affordability parameters" (DoD, 2008, p. 28).

Specifications for System Modifications/Upgrades

"Evaluation, by applicable stakeholders, of alternative corrective actions to prioritize the solutions impact on the mission and fund the preferred system implementation in accordance with program constraints" (VS, Vol. 2, 2005, p. 43).

User Input/Feedback

The user needs to provide their needs and constraints to the manufacturer in order to keep the program aligned with the initial demand of the user.

Implement Maintenance Objectives

"[Implement] maintenance considerations, constraints, and plans for operational support of the system/equipment under development" (**DAU, 2005, p. B-97)**

D. FUTURE OF MODEL

The field of HSI continues to evolve and changes occur frequently. As gaps are identified, they are then filled, which will change the nature of the findings in this thesis. However, as HSI matures, the model proposed herein serves as a baseline on which to build. Modifications are expected and welcome, as they will enrich the field of study.

E. SUMMARY

As seen from the above definitions, we have provided both a model and operational definitions for each of the elements of the model to allow the reader to fully understand the criteria that is needed to address and fill the gaps in policy that are noted in the next chapter. These definitions allow us to find the gaps in current policy and address them accordingly. In the next chapter, a gap analysis is performed, based on the definitions found in this chapter, and recommendations are made to help close the noted gaps.

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IV. GAP ANALYSIS OF DOCUMENTATION AND RECOMMENDATIONS

A. ANALYSIS

As mentioned in earlier chapters, each reference (policies, documents, etc.) used in this thesis were assigned a priority level based on the hierarchy of the Navy structure. This priority level has associated elements within the model that should be incorporated in the documentation at that particular level. In order to identify gaps in each document, we closely read and analyzed the current document, looking for areas that met the criteria laid out in the model. The elements that were not contained within the document, but were identified in the model, were noted as gaps and recorded in this chapter. Recommendations were then be made to identify ways to fill those recorded gaps.

B. PRIORITY LEVEL OF DOCUMENTS

The following documents were been broken down and were assigned a particular priority level based on the hierarchy of the authority from which the document was released. The references were assigned a level number ranging from 1 to 3, with 1 being the highest level of DoD and Navy authority and 3 being the lowest level as it relates to the IDAT&L Life Cycle Framework Management and HSI:

DODD5000.1	LEVEL 1
DODI 5000.02	LEVEL 1
CJCSI 3170.01G	LEVEL 1
OPNAVINST 5310.23	LEVEL 2
SECNAVINST 5000.2D	LEVEL 2
VS HSI GUIDE VOLUME I	LEVEL 3
VS HSI GUIDE VOLUME II	LEVEL 3
NAVSEA HSE CODE OF BEST PRACTICES	LEVEL 3

C. MODEL BREAKDOWN

Figures 2–4 are a depiction of the model used for the gap analysis, broken down by color, to show the minimum scope of responsibility for each level of documentation. It is important to remember that this breakdown is the bare minimum that must be contained in each document in order to establish a clear, understandable, and efficient guide to practice HSI within the IDAT&L Life Cycle Management Framework.

There should be a fair amount of overlap in the model within consecutive levels. This shows that the information contained within a higher-level document is being carried out by the next lower level. The idea here is that the same principles that are put in place at the highest level are still valued and followed throughout all levels of documentation. Level 1 criterion is marked on the model in red. Level 2 criteria are marked on the model in green. Level 3 criteria are marked on the model in blue.

The model is broken up into three separate figures to make it easier to read. The first figure (Figure 2) is the policy side of the Ideal Model. Figure 3 is the operational side of the model that spans through the TD Phase. Figure 4 is also the operational side of the model and covers the remainder of the life cycle through OS phase.

Figure 2. The Ideal Model (Policy Side)

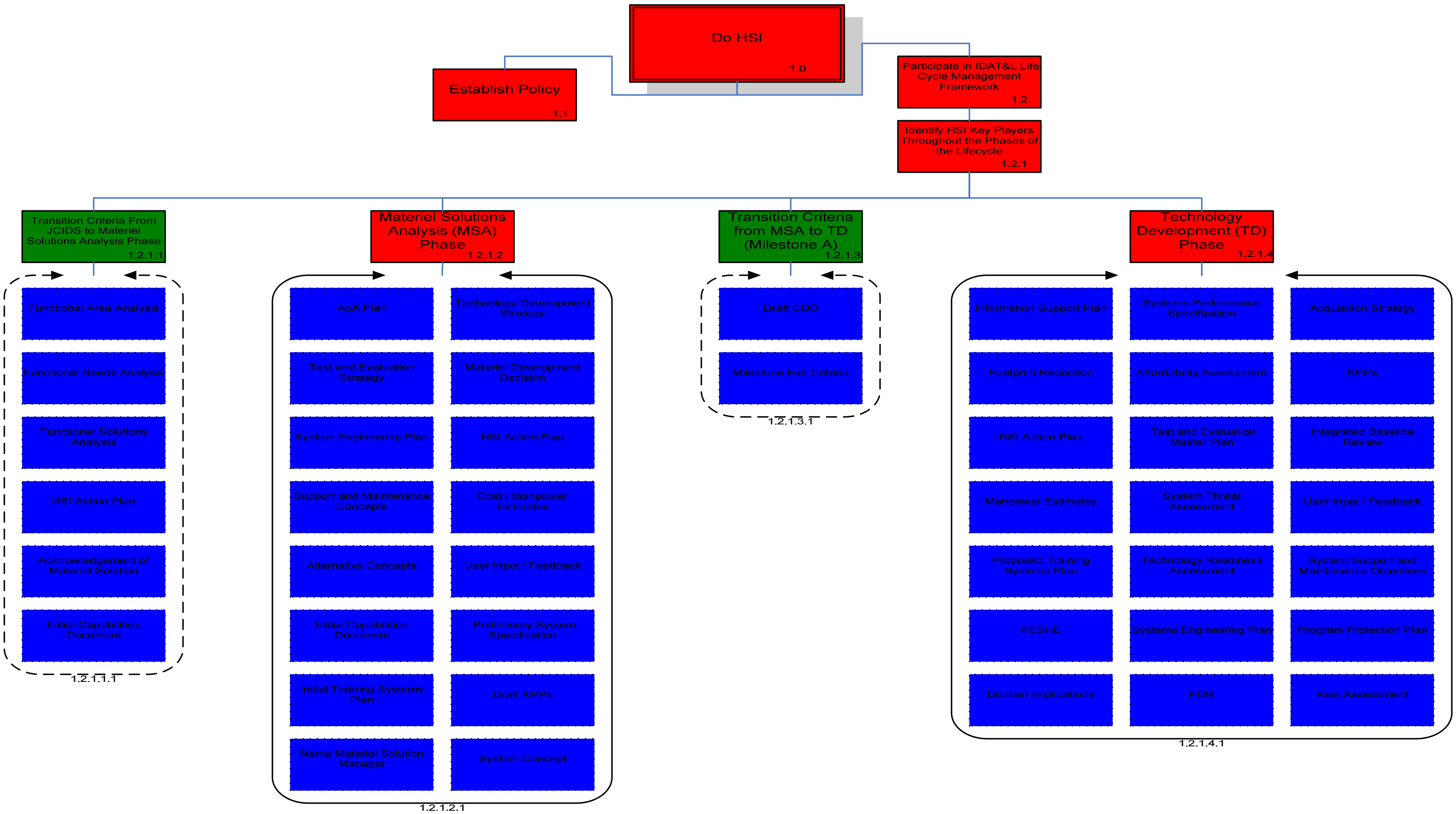

Figure 3. The Ideal Model (Operational Side through TD)

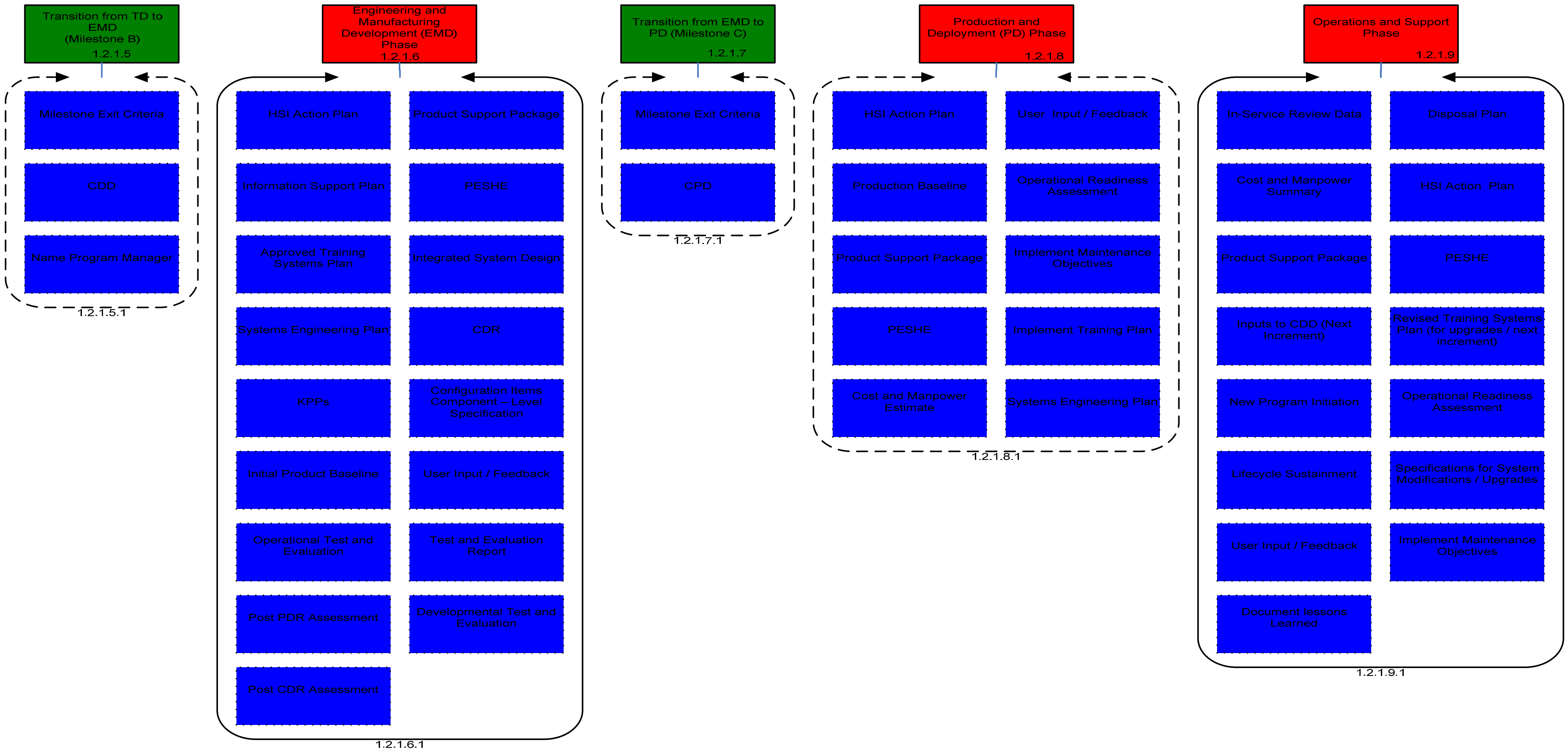

Figure 4. The Ideal Model (Operational Side through OS)

D. DOCUMENT GAPS AT LEVEL 1

1. DoDD 5000.1

Although the purpose of this document is to “provide management principles and mandatory policies and procedures for managing all acquisition programs” (DoD, 2003, p. 1 (a)), this document fails to address the following criteria established by the model, therefore making them gaps in the current policy. We acknowledge that DoDI 5025.01 constrains the length of DoD Directives to eight pages and, therefore, would limit the amount of information that can be addressed, but we feel that these gaps are very important to successful HSI implementation. We have included the portions of the model that pertain to each level to allow the reader to visually see where the gaps are in each level on the model for this specific document. The boxes that have a yellow outline/ dots around them are the gaps we have identified. Additionally, the gaps are also listed in bullet format. Figure 5 shows the gaps in the policy side of the model for this document. Figure 6 shows the gaps in the operational side of the model through TD for this document. Figure 7 shows the gaps in the operational side of the model through OS for this document.

- Do HSI
- Establish Policy
- Participate in the IDAT&L Life Cycle Management Framework
- Establish HSI reporting authority
- Define HSI and domains
- Identify HSI Key Players throughout the phases of the Life Cycle (DoD)
- Materiel Solutions Analysis Phase
- Technology Development Phase
- Engineering and Manufacturing Development Phase
- Production and Deployment Phase
- Operations and Support Phase

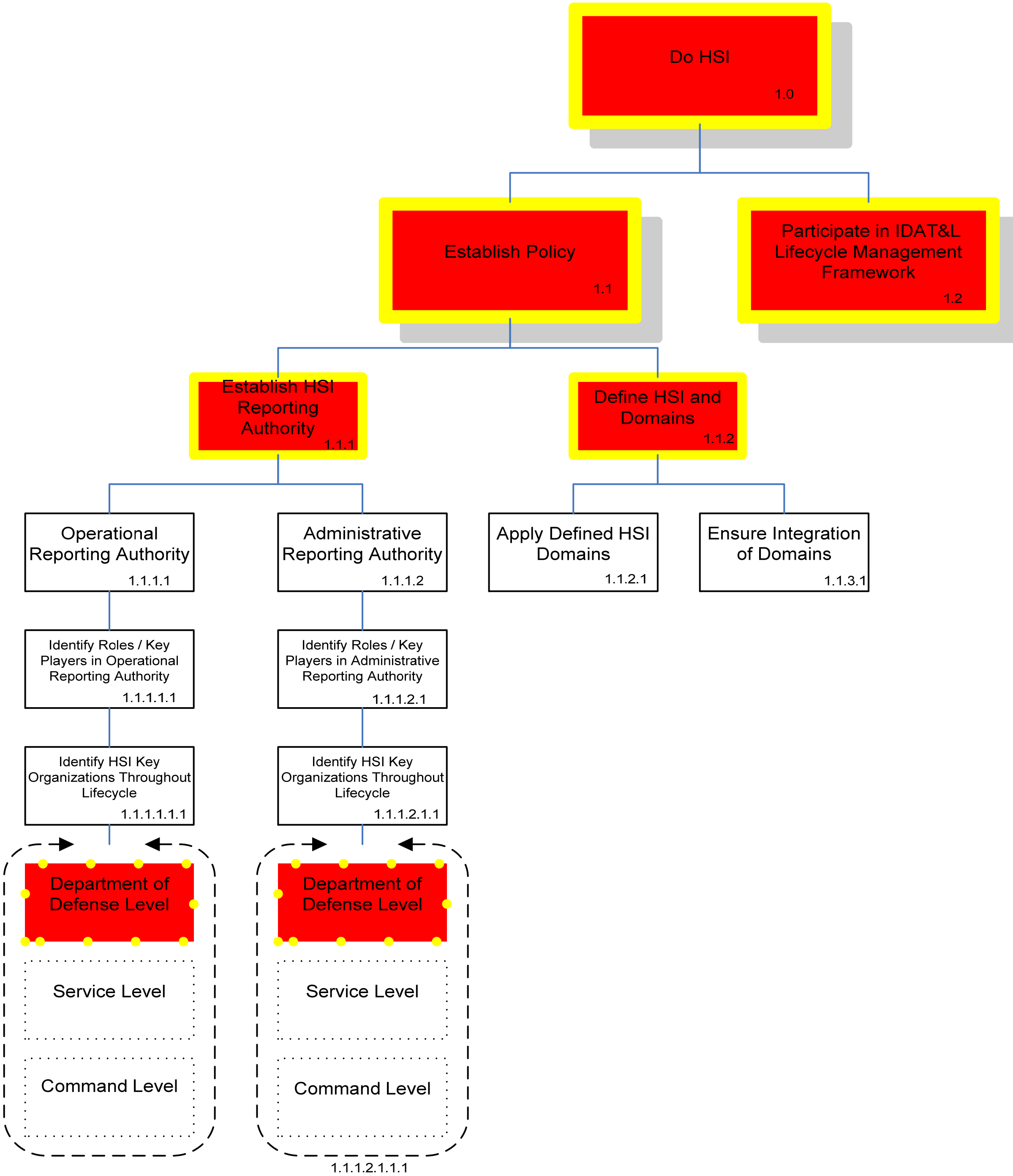

Figure 5. Gaps Identified in DoDD 5000.1 (Policy Side)

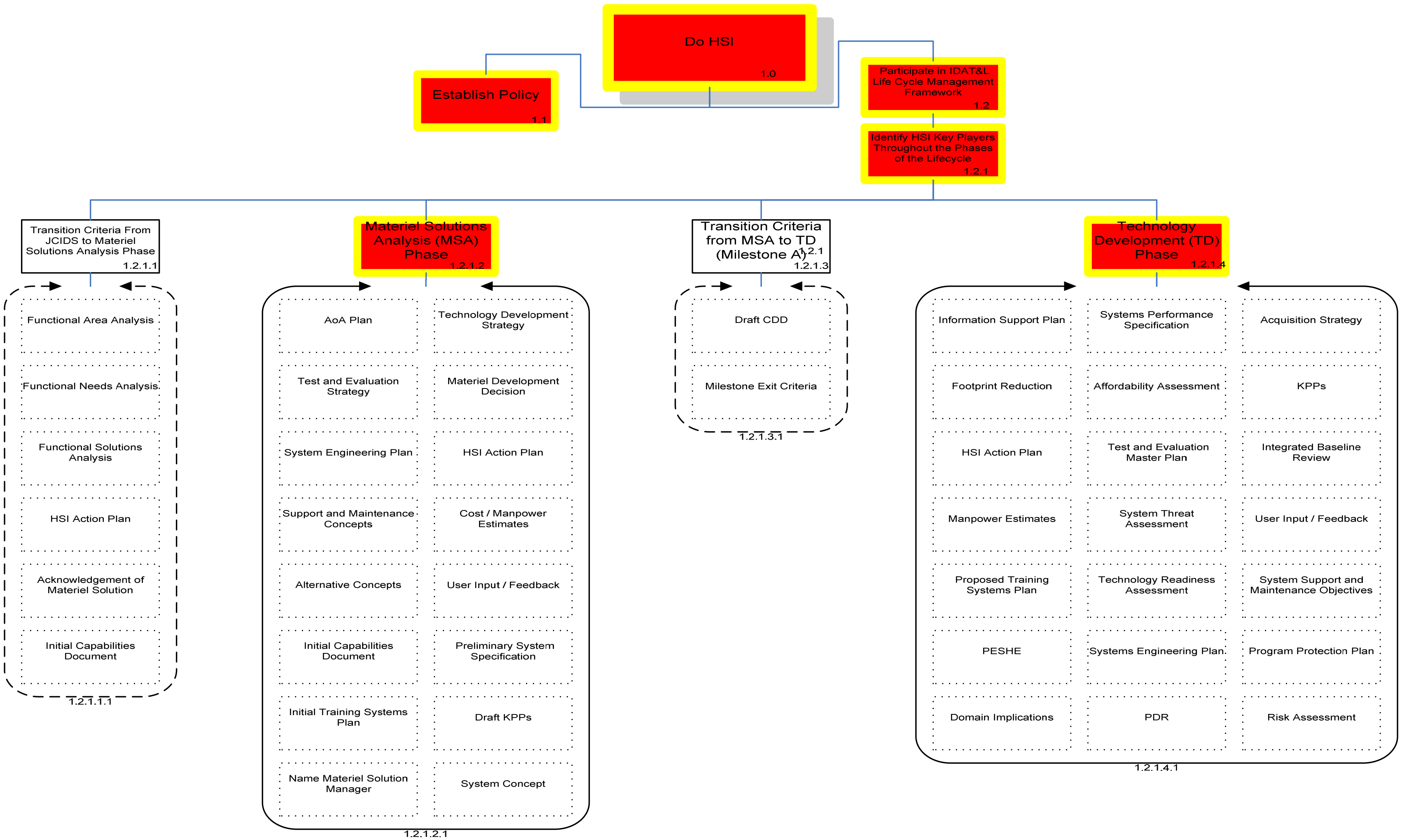

Figure 6. Gaps Identified in DoDD 5000.1 (Operational Side through TD)

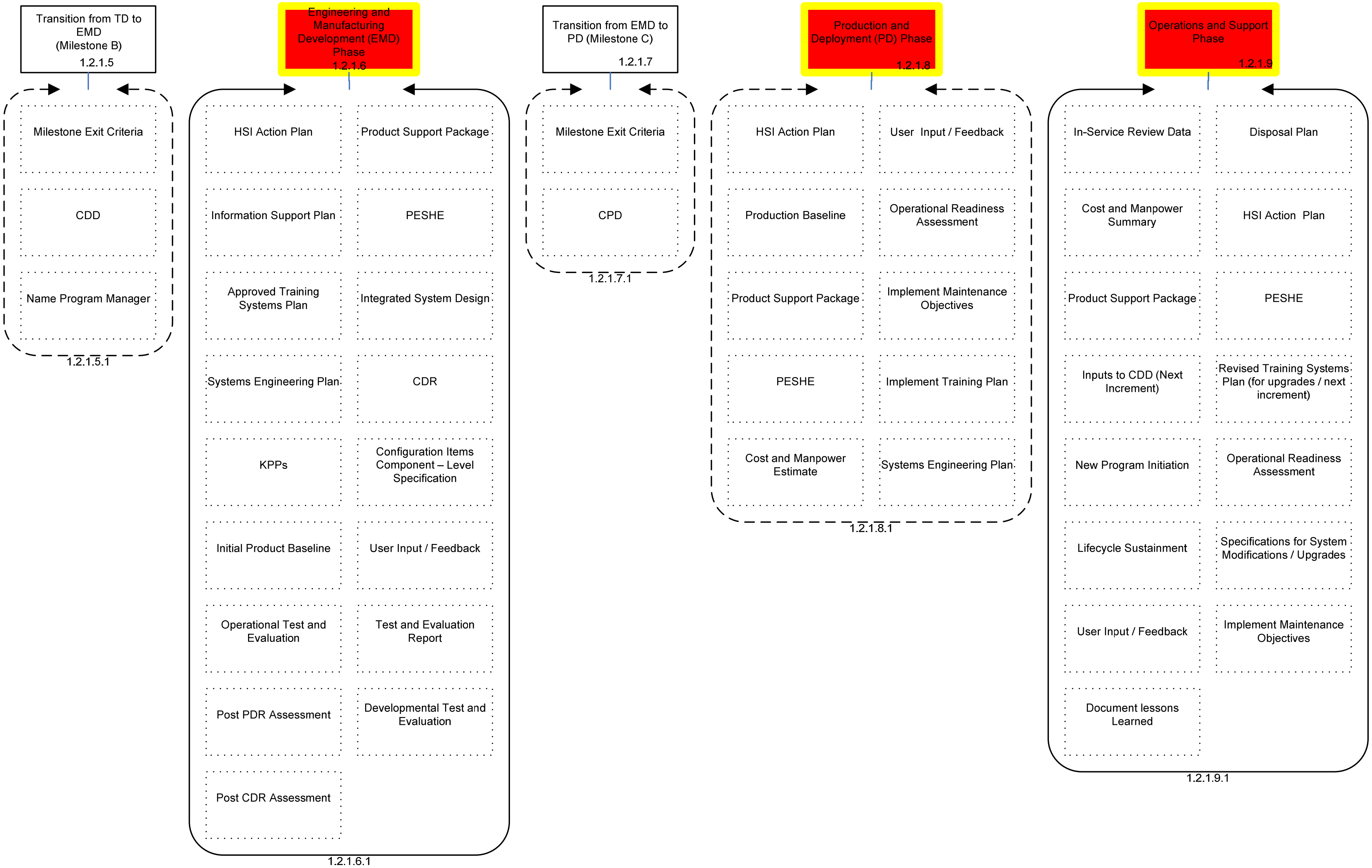

Figure 7. Gaps Identified in DoDD 5000.1 (Operational Side through OS)

As noted from Chapter III, and the definitions of each of these phase items, this document misses the mark on all requirements for this level of documentation. We feel that it is important to lay a strong, solid, and well-defined foundation on which to build. Although this document does mention cost and affordability, integrated test and evaluation, interoperability, safety, systems engineering, technology development and transition, and total systems approach—all of which are essential to successfully implementing HSI—it neglects to lay the foundation for the importance of HSI within the IDAT&L Life Cycle Management Framework. Policy is mentioned in the document; however, it merely refers to the Defense Acquisition System as a whole, and does not mention HSI as part of that system. HSI is, however, mentioned as part of a total system approach that the PM is responsible and accountable to use, but no guidance is given as to any of the above items listed as gaps in the document. Overall, this document needs massive improvements in order to provide the necessary information to successfully adapt and use HSI throughout the IDAT&L Life Cycle Management Framework.

2. DoDI 5000.02

The purpose of this document is not only to implement DoDD 5000.1, but also to "establish a simplified and flexible management framework for translating capability needs and technology opportunities, based on approved capability needs, into stable, affordable, and well managed acquisition programs" (DoD, 2008, p. 1). This document, along with the other two documents at this level, should serve as the foundation for HSI to build on during the IDAT&L Life Cycle Management Framework. After analyzing this document, the items below are noted as gaps because the document fails to make reference to them in its current standing. We have included the portions of the model that pertain to each level to allow the reader to visually see where the gaps are in each level on the model for this specific document. The boxes that have a yellow outline are the gaps we have identified. Additionally, the gaps are also listed in bullet format. Figure 8 shows the gaps in the policy side of the model for this document. Figure 9 shows the gaps in the operational side of the model through TD for this document. Figure 10 shows the gaps in the operational side of the model through OS for this document.

- Establish HSI Policy
- Establish HSI Reporting Authority
- Define HSI and Domains
- Identify HSI Key Players throughout the phases of the Life Cycle

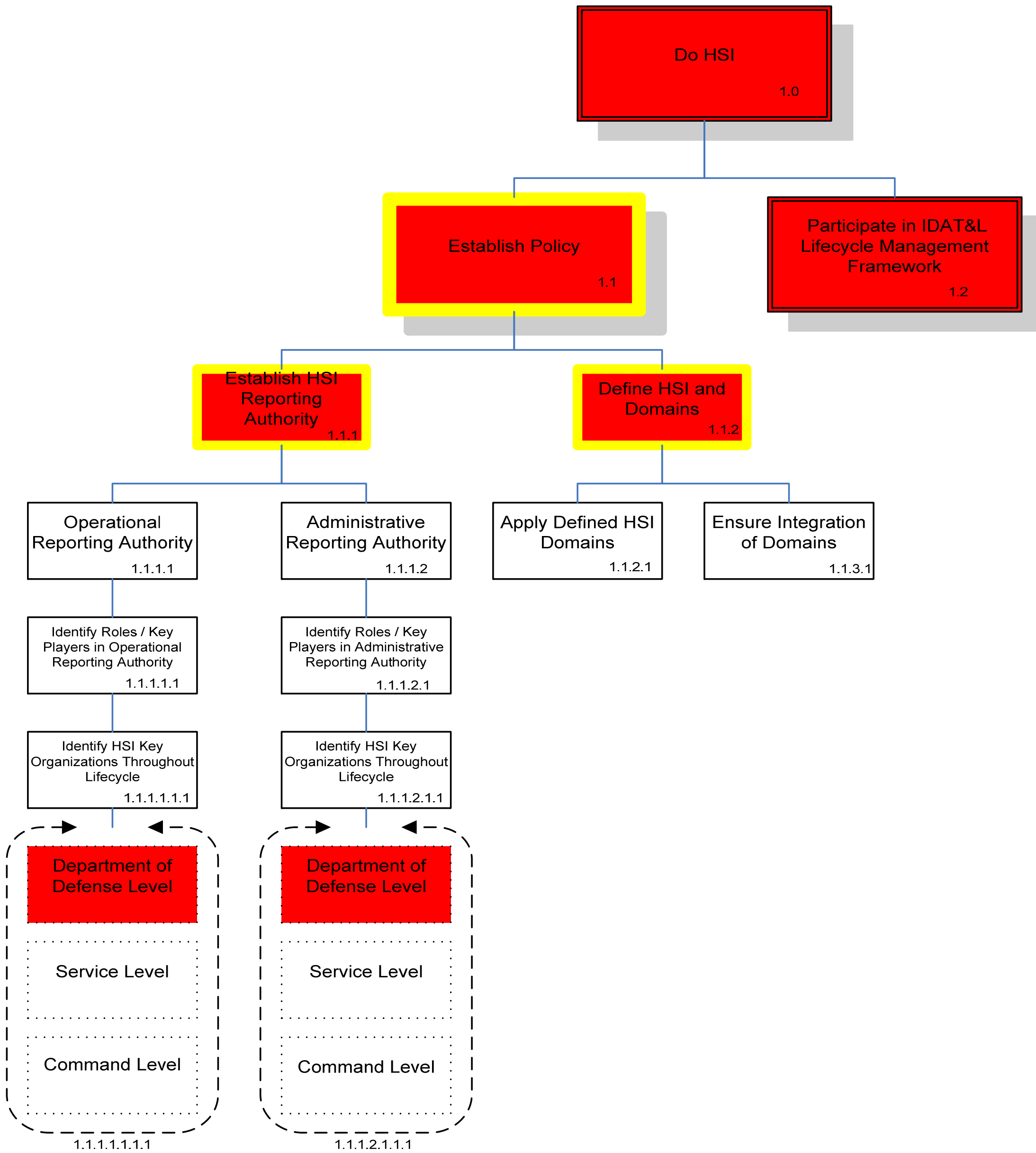

Figure 8. Gaps Identified in DoDI 5000.02 (Policy Side)

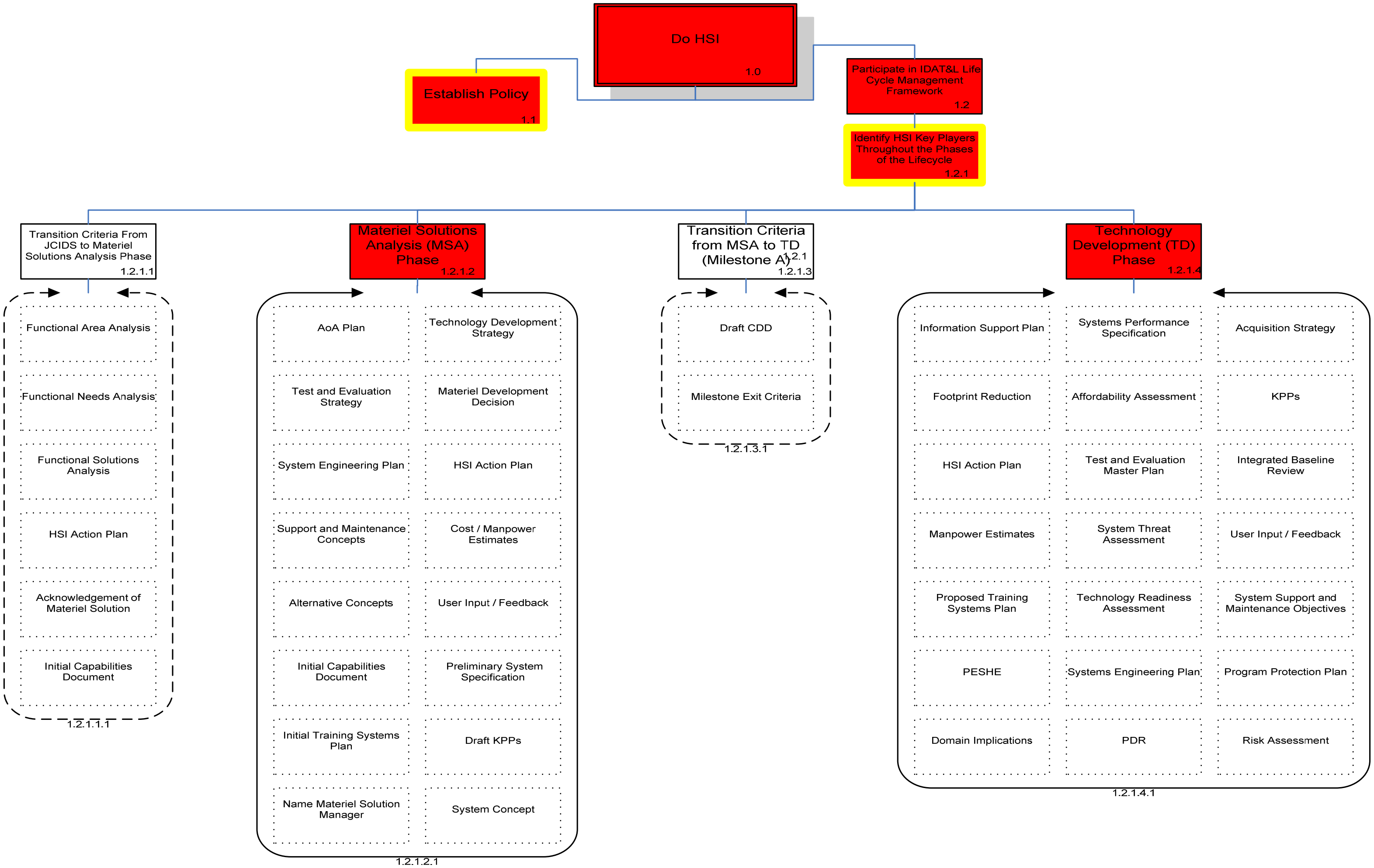

Figure 9. Gaps Identified in DoDI 5000.02 (Operational Side through TD)

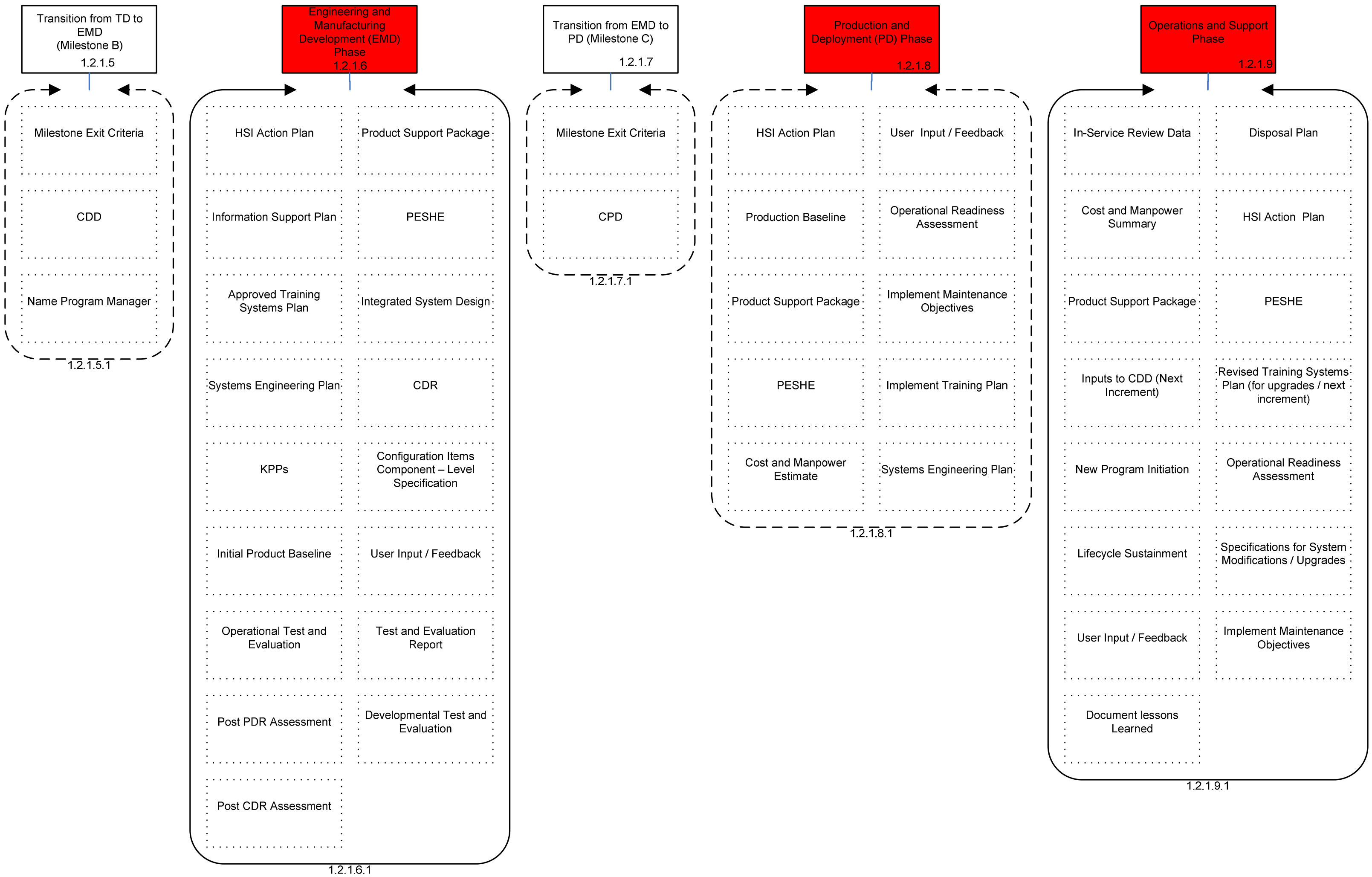

Figure 10. Gaps Identified in DoDI 5000.02 (Operational Side through OS)

Based on the definitions provided in Chapter III, this document fails to adequately address the above items. DoDI 5000.02 places a heavy emphasis on the PM for implementing HSI throughout the acquisition process, but fails to identify any other specific players. The document makes an attempt at identifying the domains of HSI, but neglects to define HSI. Other items, such as user needs, T&E, cost estimation, and Systems Engineering, are incorporated into the document to provide insight and information as to the operation of these items within the acquisition process. The mention of these items does not negate the need for the foundation level items associated with level 1 documentation.

3. CJCSI 3170.01F

The purpose of this document is to establish the policies relating to the JCIDS. This document also serves as a foundation level document at the highest level of the DoD's hierarchy. After reviewing this document, we concluded that the following gaps exist within the document as it is currently written. We have included the portions of the model that pertain to each level to allow the reader to visually see where the gaps are in each level on the model for this specific document. The boxes that have a yellow outline are the gaps we have identified. Additionally, the gaps are also listed in bullet format. Figure 11 shows the gaps in the policy side of the model for this document. Figure 12 shows the gaps in the operational side of the model through TD for this document. Figure 13 shows the gaps in the operational side of the model through OS for this document.

- Do HSI
- Establish HSI Policy
- Establish HSI reporting authority
- Identify HSI Key Players throughout the phases of the Life Cycle (DoD)
- Materiel Solutions Analysis Phase
- Technology Development Phase
- Engineering and Manufacturing Development Phase
- Production and Deployment Phase
- Operations and Support Phase

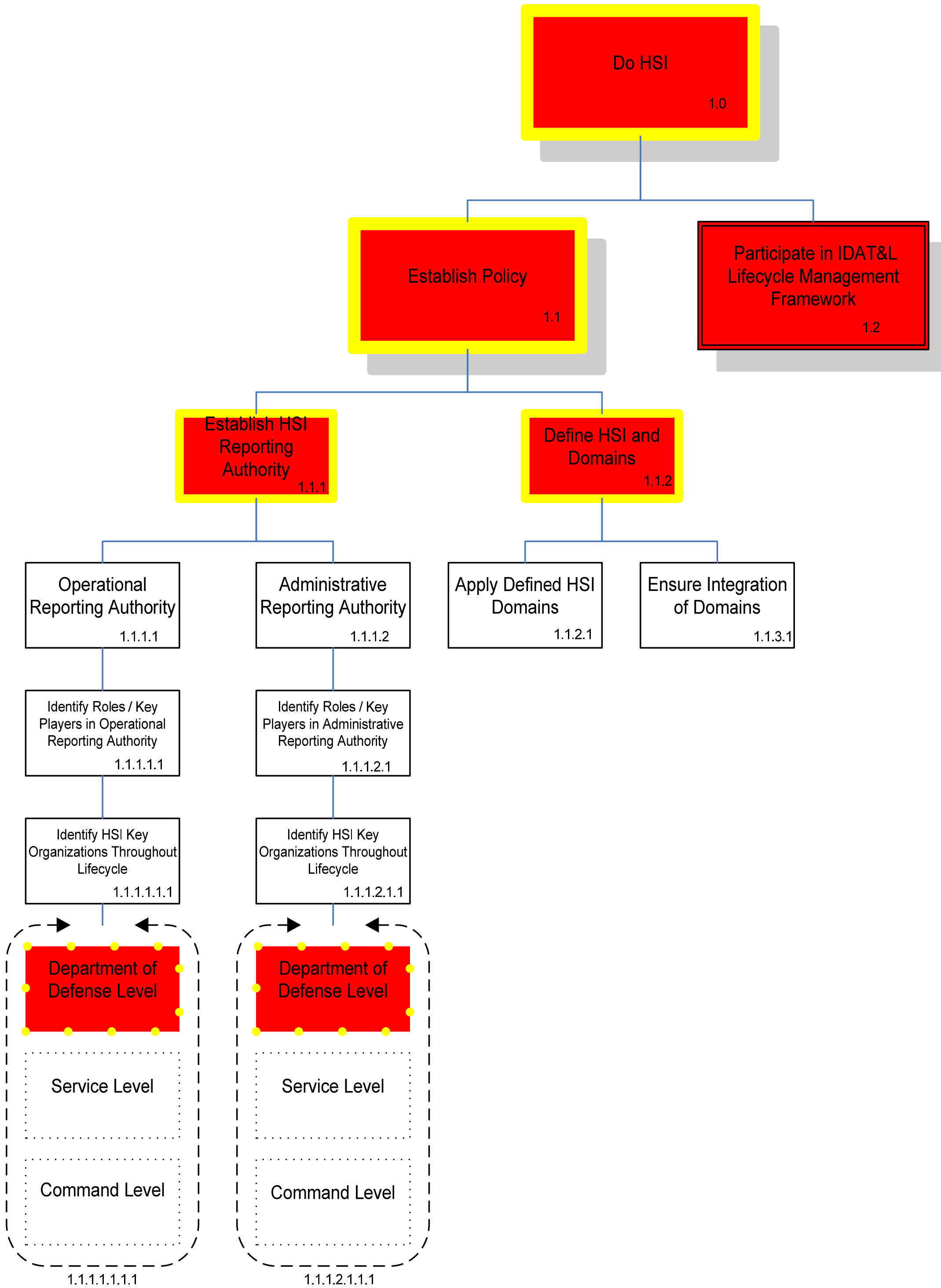

Figure 11. Gaps Identified in CJCSI 3170.01F (Policy Side)

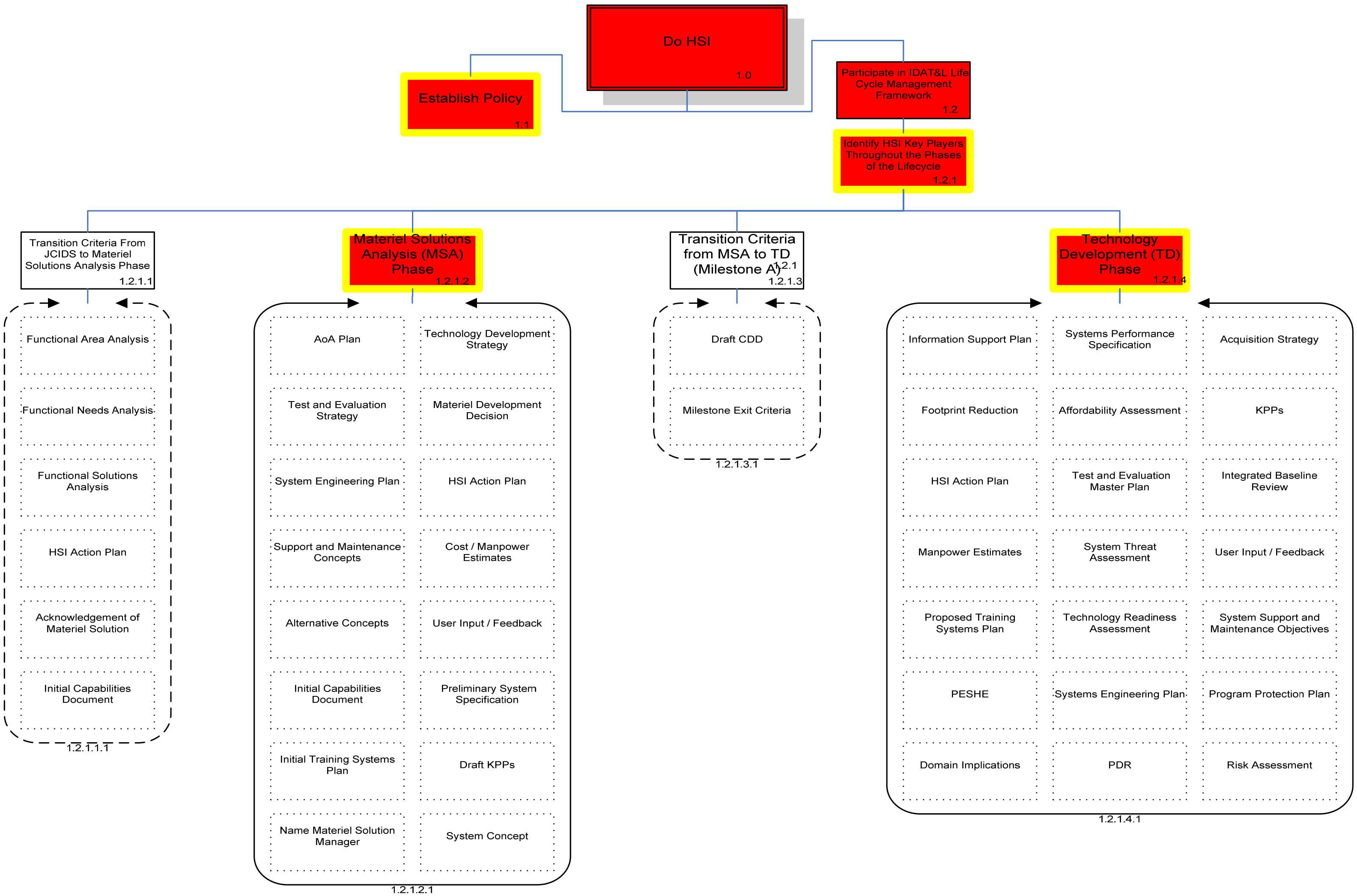

Figure 12. Gaps Identified in CJCSI 3170.01F (Operational Side through TD)

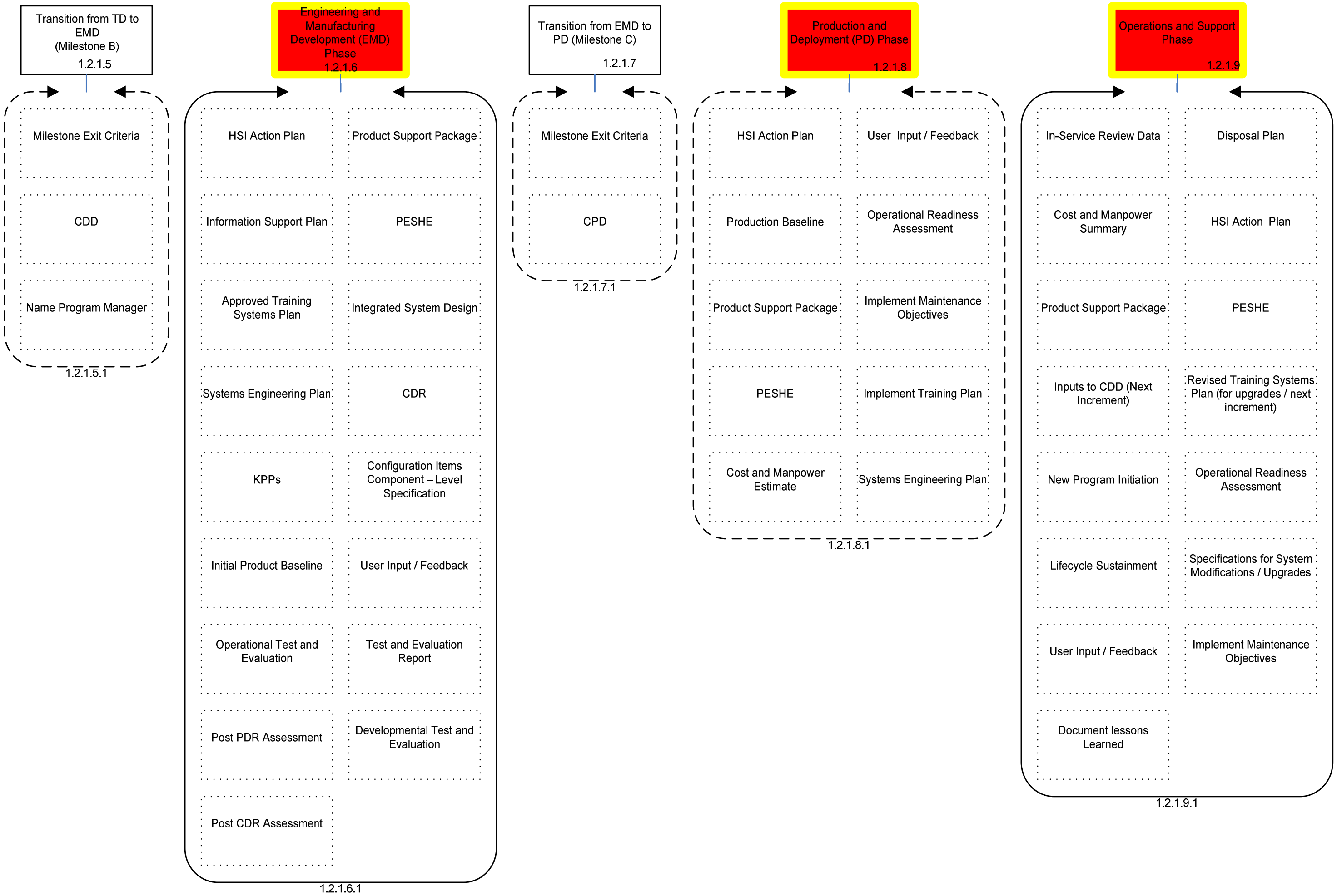

Figure 13. Gaps Identified in CJCSI 3170.01F (Operational Side through OS)

Although this document misses the mark according the model on level 1 requirement, it does establish several key processes that must take place in order to produce capabilities that will benefit the warfighter. These processes include the requirements process, the acquisition process, and the planning, programming, budgeting and execution (PPBE) process. It walks through the entire JCIDS process, beginning with identifying the capabilities necessary to perform across a full range of military operations and ending with the JCIDS document review, validation, and approval process. Between those two points, document relationships are addressed including the ICD, CDD, and Capabilities Production Document (CPD).

Throughout the document, simple references are made to implementing and using HSI in the JCIDS process; however, the references are vague and generally require a preliminary understanding of HSI.

4. RECOMMENDATIONS FOR LEVEL 1 DOCUMENTS

At the highest level, regardless of the purpose of the document, the act of performing HSI must be established. The three documents listed at the highest level—DoDD 5000.1, DoDI 5000.02, and CJCSI 3170.01F— have different purposes; however, they all address some aspect of the acquisition process. In order for HSI to trickle down through the levels of documentation, the actual act of performing HSI must be acknowledged and addressed as a process, rather than just a single mention that HSI shall be conducted by the PM. As mentioned in Chapter III, the act of doing HSI is defined as

> . . . the process of conducting Human Systems Integration is intended to integrate human related issues into the development of the product by identifying specific human-related and mission-related performance and system design requirements, communicating those requirements throughout the design process, and ensuring those requirements are met (VS, Vol. 2, 2005, p. 12).

This process is essential and must be imbedded at the highest possible level to ensure that HSI is performed with continuity throughout the Acquisition Life Cycle. Currently, we have identified that this gap exists within both DoDD 5000.1 and CJCSI 3170.01F. We recognize that DoDI 5000.02 addresses the mere act of doing HSI; however, it does not encompass and address the definition provided above. If kept as is, the definition from DoD 5000.02 must also be included in the other two documents named; however, that situation is not ideal. Implementing the new definition of the process of doing HSI in all three documents will better lay the foundation for continuity among the documents and provide clear guidance for lower-level policy.

We acknowledge that all three documents at this level establish policy and guidance with respect to differing parts of acquisition. However, none of the documents attempt to establish policy directly related to HSI, which is why a gap is present in all the documents. HSI policy is defined as a planned course of action that is intended to be used to set forth guiding principles and procedures for ensuring that HSI is properly embedded throughout the entire acquisition strategy to produce the most advantageous products to the user at the lowest possible cost. The policies that are currently set forth in the documents address HSI as an act rather than a process. By acknowledging HSI as a process, policy can easily be established at the highest level to ensure implementation through all levels of documentation, as well as all phases of the Acquisition Life Cycle.

DoDD 5000.1 has a gap in block 1.2, denoted as "participate in the IDAT&L Life Cycle Management Framework." This gap is not present in the other two documents in level 1. Based on that fact, it is not *necessary* to implement change in DoD 5000.1, however, a change is recommended. Since the purpose of DoDD 5000.1 is to "provide management principles and mandatory policies and procedures for managing all acquisition programs," (DoD, 2003, p. 1 (a)) it is difficult to effectively make that claim without addressing participation in the Life Cycle framework. One can make the assumption of participation; however, it is not explicitly stated.

Based on our model, the establishment of an HSI reporting authority is critical for oversight of HSI in the acquisition process. The CJCSI 3170.01F outlines several joint staff directors who are responsible for individual domains; however, there is no integrative structure to look at HSI as a single process, rather than just individual domains. In an ideal setting, the HSI reporting authority should be implemented as a structure to ensure an open line of communication throughout all organizations in HSI and the acquisition framework, from top to bottom, to effectively track and report on all HSI-relevant areas and provide oversight for successful program acquisition. This authority should include personnel from specific services as the primary cornerstones of the authority, and be supplemented by joint figures when deemed necessary for a specific program. The domains need to be addressed as integrated parts of the process to allow trade-off to occur, rather than being addressed individually. In order for HSI to be effective, the domains cannot exist independently from one other.

Establishing a single definition for HSI is imperative for allowing this process to move forward and be fully integrated into the acquisition process. A definition gap has been identified within DoD 5000.1 and DoD 5000.02. A definition is provided for HSI in the CJCSI 3170.01F; however, the definition centers on an outdated document (DoD 5000.2, 2005) and the individual domains that make up HSI. As an alternative, we recommend that HSI be explicitly defined in all three documents as an

> . . . acknowledgement that the human is a critical component of any complex system. It is an interdisciplinary approach that makes explicit the underlining tradeoffs across the HSI domains, facilitating optimization of total system performance. (Miller & Shattuck, 2006, p. 4)

By implementing this definition at the highest level of documentation, we feel confident that it will provide clear guidance for the lower levels. It will also set the precedence that this definition must be followed by all levels, therefore establishing continuity across all levels. In addition to the definition, the following domains must remain as cornerstones of the HSI process: Manpower, Personnel, Training, Safety, Occupational Health, Habitability, Survivability, Environment and Human Factors Engineering. CJCSI 3170.01F lists the domains without defining them. However, DoDI 5000.02 defines the domains clearly and provides explicit deliverables. These domains and definitions must be updated to reflect the same definition and description of domains in each document. Currently, DoDD 5000.1(2003) does not address domains at all.

Just as establishing a common definition for HSI is essential, so is identifying key players throughout the phases of the Life Cycle. Currently, the documentation shows a gap in all three documents leveling this area. It is recommended that key players be named throughout the Life Cycle including users, stakeholders, engineers, managers, etc. to ensure continuity and establish a solid framework for conducting HSI activities throughout the process. By identifying key players early and at the highest level of documentation, HSI will not fall by the wayside at various stages of the Life Cycle. In addition, these HSI and specific individuals can be held accountable for deliverables involving HSI trade-offs. These players must be established in at least one of the three documents, if not all three, to clearly identify these individuals and help create an HSI reporting structure.

DoDI 5000.02 clearly defines and details the five phases of the acquisition process (MSA, TD, EMD, PD, and Operations and Support (OS)), however, it does not fully define the role that HSI plays within those phases. By using the recommendations above, clearly defining HSI, establishing HSI policy, and recognizing participation in the IDAT&L Life Cycle management framework, it is imperative that these definitions must be amended to include the specific attributes and roles that HSI practitioners play. Once these definitions are amended, they must be carried through to ensure continuity throughout the Life Cycle. Neither DoDD 5000.1 nor CJCSI 3170.01F mention or define the phases. Because DoDI 5000.02 is fairly thorough, it meets the minimum requirement for the documents at this level. There would be no harm in implementing them in the other two documents; however, implementation is not necessary.

Overall, the level 1 documents fail to meet the mark on many key points, leaving many gaps according to the model; however, the changes that are required to lay a solid foundation and amend the documents to fill the gaps are reasonable and will provide concrete footing for HSI in the acquisition world.

E. DOCUMENT GAPS AT LEVEL 2

1. OPNAVINST 5310.23

The purpose of this instruction is to address HSI throughout the Navy. It was established through the Office of the Chief of Naval Operations and is the Navy's overarching documentation on how HSI should be structured in the Navy. As of January 2009, this policy has not been officially signed, so it is still considered in draft form. Analysis of this documentation identified the following gaps. We have included the portions of the model that pertain to each level to allow the reader to visually see where the gaps are in each level on the model for this specific document. The boxes that have a yellow outline are the gaps we have identified. Additionally, the gaps are also listed in bullet format. Figure 14 shows the gaps in the policy side of the model for this document. Figure 15 shows the gaps in the operational side of the model through TD for this document. Figure 16 shows the gaps in the operational side of the model through OS for this document.

- Define HSI and Domains
- Operational Reporting Authority
- Administrative Reporting Authority
- Identify Roles/Key Players in Operational Reporting Authority
- Identify Roles/Key Players in Administrative Reporting Authority
- Identify Key Organizations throughout the Life Cycle at the Service Level (Operational)
- Identify Key Organizations throughout the Life Cycle at the Service Level (Administrative)
- Apply Defined HSI Domains
- Ensure Integration of Domains
- Identify HSI Key Players throughout the Phases of the Life Cycle
- Technology Development Phase
- Transition from Technology Development Phase to Engineering and Manufacturing Development Phase
- Engineering and Manufacturing Development Phase
- Transition from Engineering and Manufacturing Development Phase to Production and Deployment Phase
- Production and Deployment Phase
- Operations and Support Phase

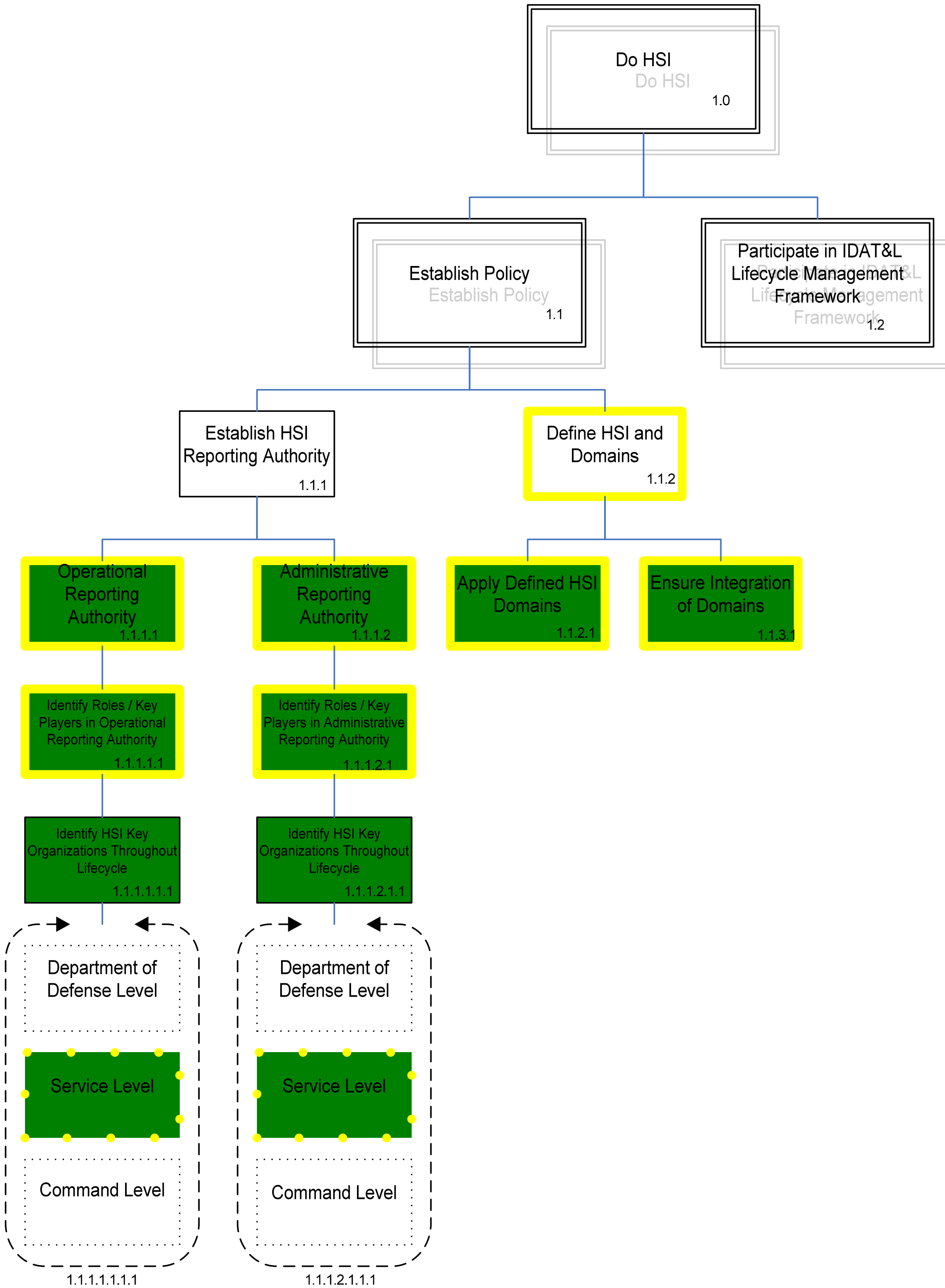

Figure 14. Gaps Identified in OPNAVINST 5310.23 (Policy Side)

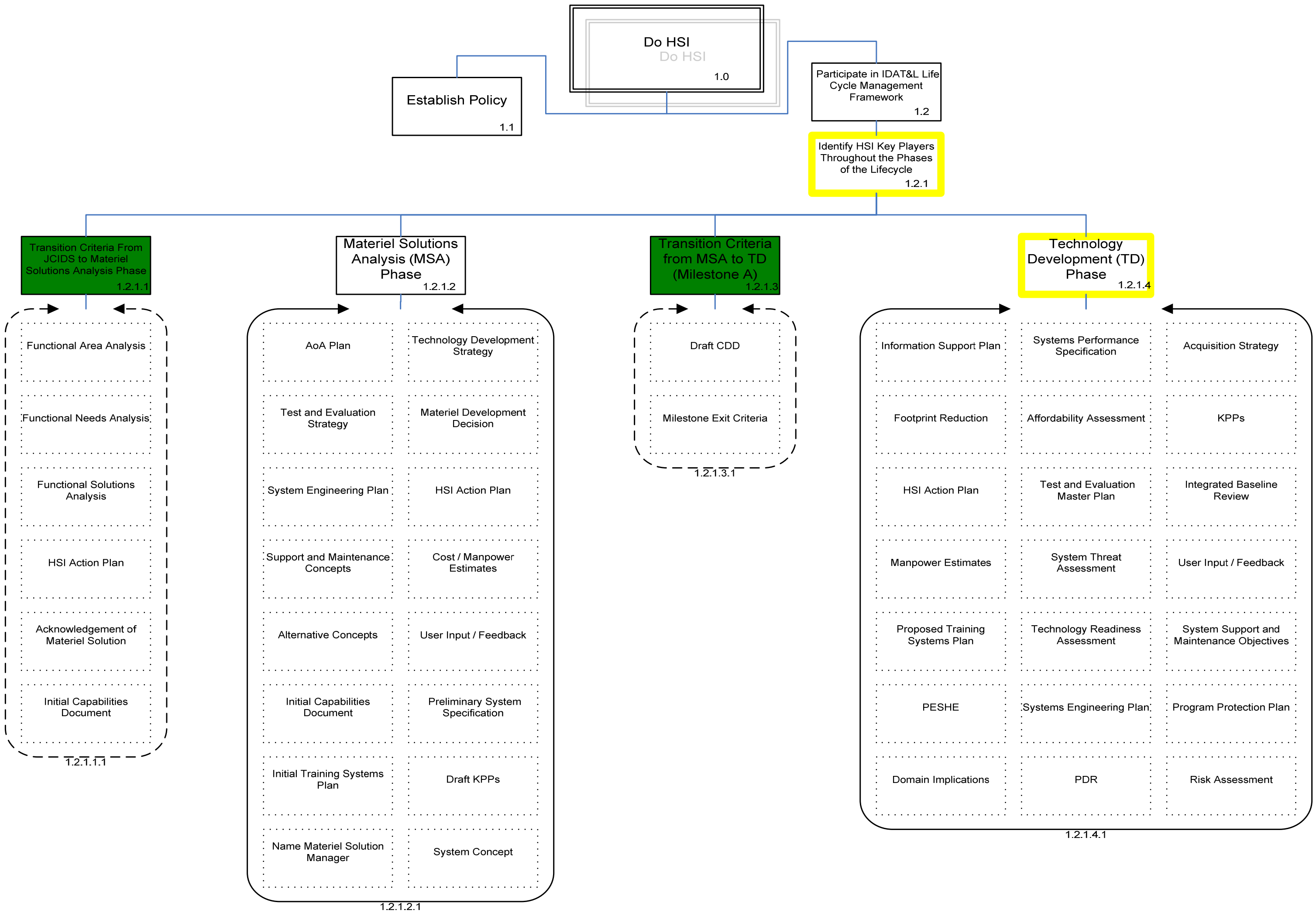

Figure 15. Gaps Identified in OPNAVINST 5310.23 (Operational Side through TD)

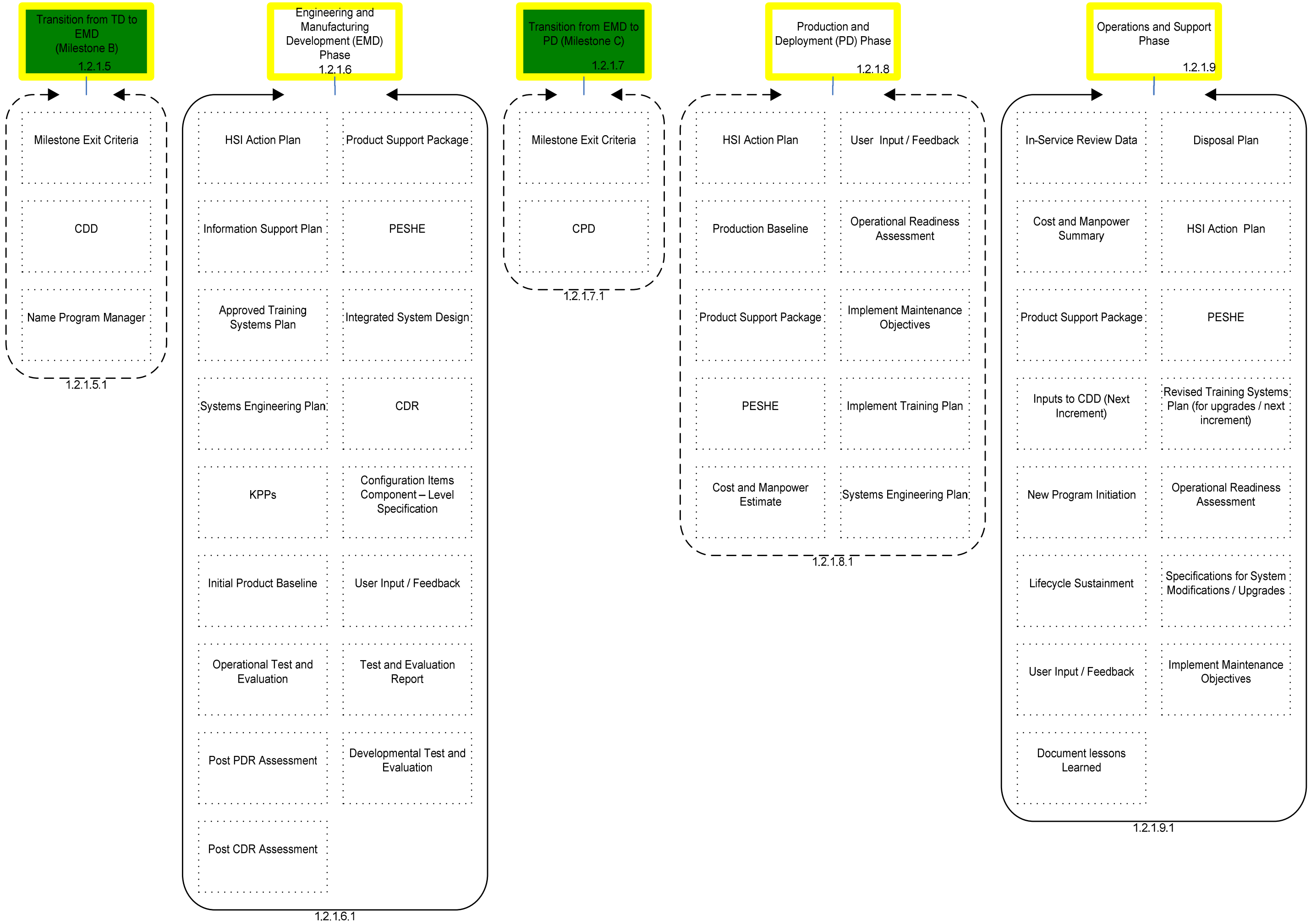

Figure 16. Gaps Identified in OPNAVINST 5310.23 (Operational Side through OS)

2. SECNAVINST 5000.2D

The main purpose of SECNAVINST 5000.2D is to give the Navy guidance on how to merge the JCIDS and the acquisition process. This document includes chapters on systems engineering and HSI. After reviewing this instruction, the following items are identified as gaps within our model. We have included the portions of the model that pertain to each level to allow the reader to visually see where the gaps are in each level on the model for this specific document. The boxes that have a yellow outline are the gaps we have identified. Additionally, the gaps are also listed in bullet format. Figure 17 shows the gaps in the policy side of the model for this document. Figure 18 shows the gaps in the operational side of the model through TD for this document. Figure 19 shows the gaps in the operational side of the model through OS for this document.

- Define HSI and Domains
- Operational Reporting Authority
- Administrative Reporting Authority
- Identify Roles/Key Player in Operational Reporting Authority
- Identify Roles/Key Players in Administrative Reporting Authority
- Identify Key Organizations throughout the Life Cycle at the Service Level (Operational)
- Identify Key Organizations throughout the Life Cycle at the Service Level (Administrative)
- Apply Defined HSI Domains
- Ensure Integrations of Domains
- Identify HSI Key Players throughout the Phases of the Life Cycle
- Transition Criteria from JCIDS to Materiel Solutions Phase
- Materiel Solutions Analysis Phase
- Transition Criteria from Materiel Solutions Phase to Technology Development Phase
- Technology Development Phase
- Transition Criteria from Technology Development Phase to Engineering and Manufacturing Development Phase

- Engineering and Manufacturing Development Phase
- Transition Criteria from Engineering and Manufacturing Development Phase to Production and Deployment Phase
- Production and Deployment Phase
- Operations and Support Phase

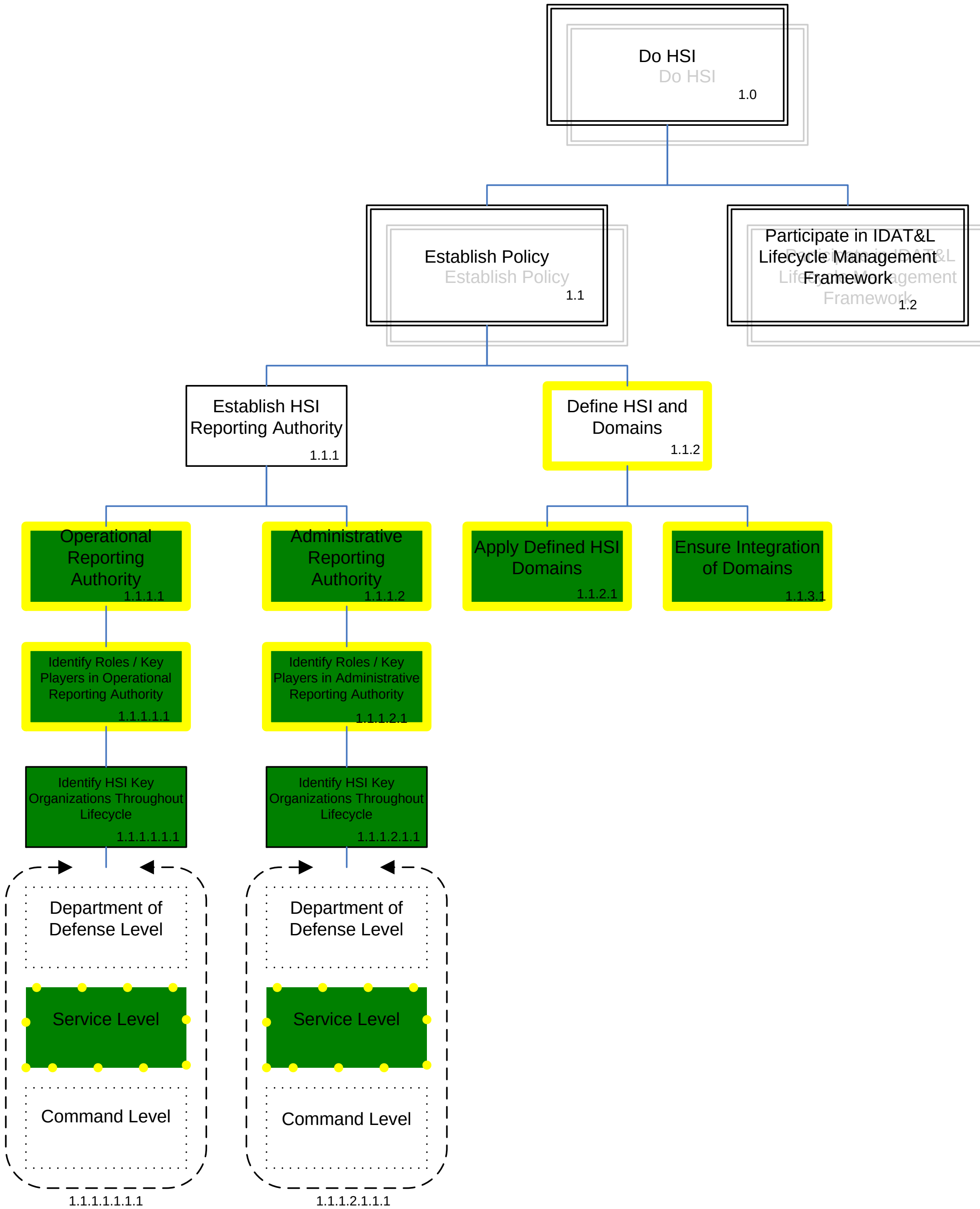

Figure 17. Gaps Identified in SECNAVINST 5000.2D (Policy Side)

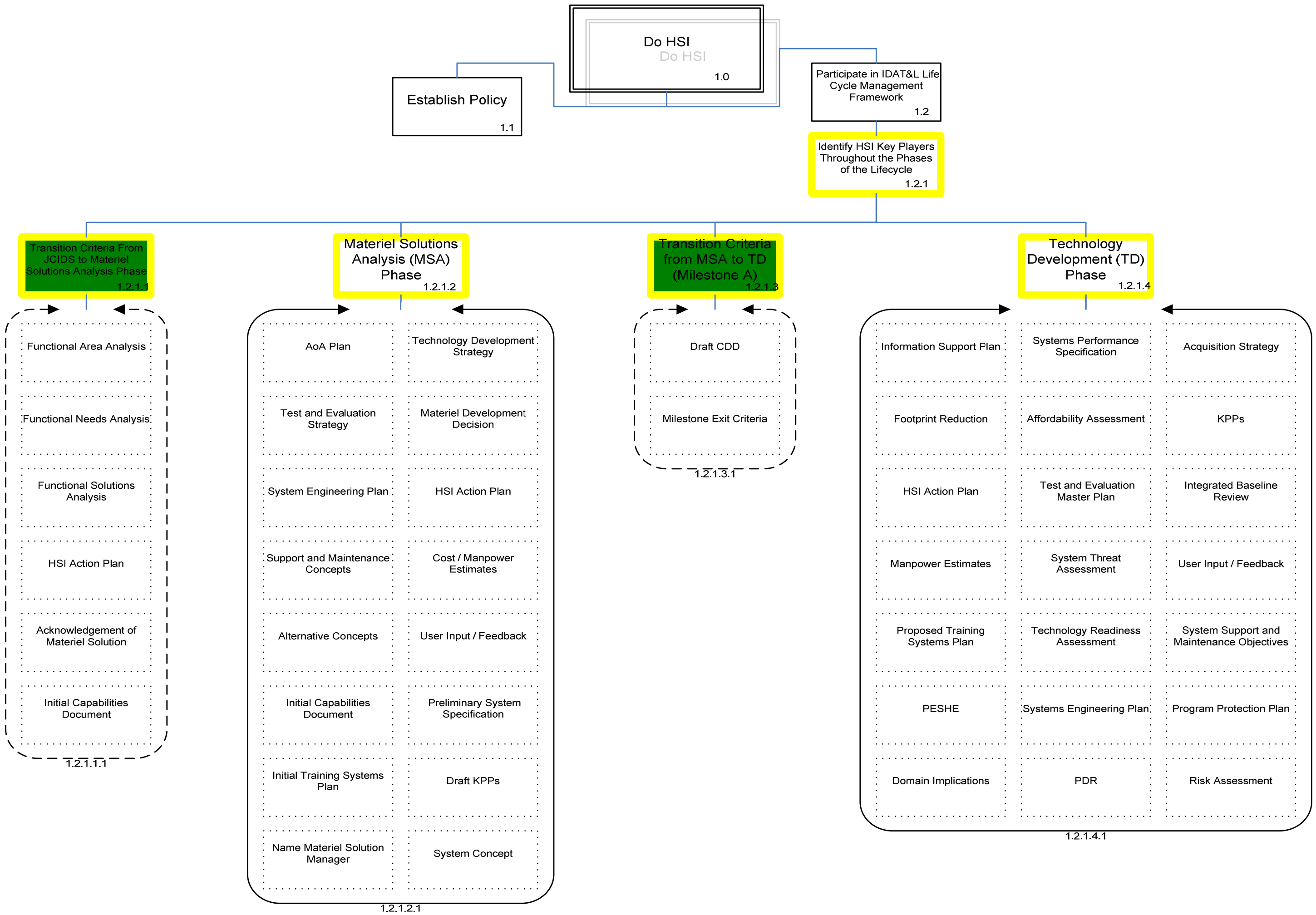

Figure 18. Gaps Identified in SECNAVINST 5000.2D (Operational Side through TD)

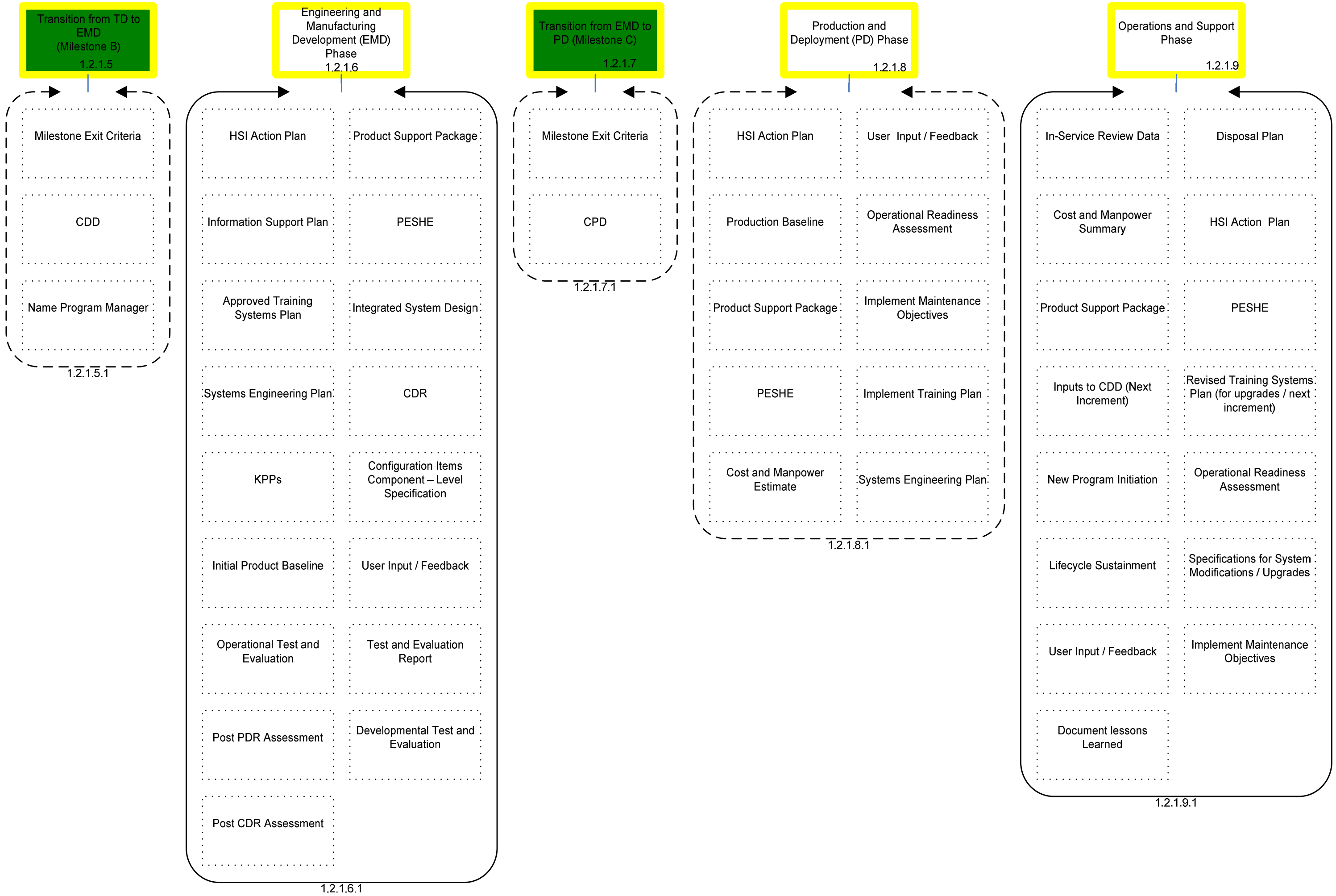

Figure 19. Gaps Identified in SECNAVINST 5000.2D (Operational Side through TD)

3. RECOMMENDATIONS FOR LEVEL 2 DOCUMENTS

Our model was developed to ensure that all the policy and guidance flows from the highest levels of documentation down to the lowest levels. This means policy that was stated previously at the highest level, must also be included at the lowest levels. Therefore, the reader will note that we state “recommendation referred to at the highest level.” By this, we are trying to avoid restating the recommendations previously given.

Having a single definition and list of HSI domains is imperative for the initial steps of unifying the HSI and acquisition process. Without a single, common definition throughout all of the DoD and DoN policies, the meaning and purpose of HSI will be interpreted differently by each user. There is a gap in both OPNAVINST 5310.23 and SECNAVINST 5000.2D, with respect to the definition of HSI and the domains. The recommendation to close the gap was referenced above in the Level 1 documentation.

Having a reporting authority for both the operational and administrative chain of commands is imperative. These are two distinct functions of our military that need to have people informed of the HSI process within their offices. We have noted a gap for both documents and recommend that someone be appointed as the HSI Operational Reporting Authority, along with the HSI Administrative Reporting Authority, to ensure that information from all areas of HSI is being reported to the overall HSI Reporting Authority. See Figure 20 for visual breakdown. Level 1 criterion is marked on the model in red. Level 2 criteria are marked on the model in green. Level 3 criteria are marked on the model in blue.

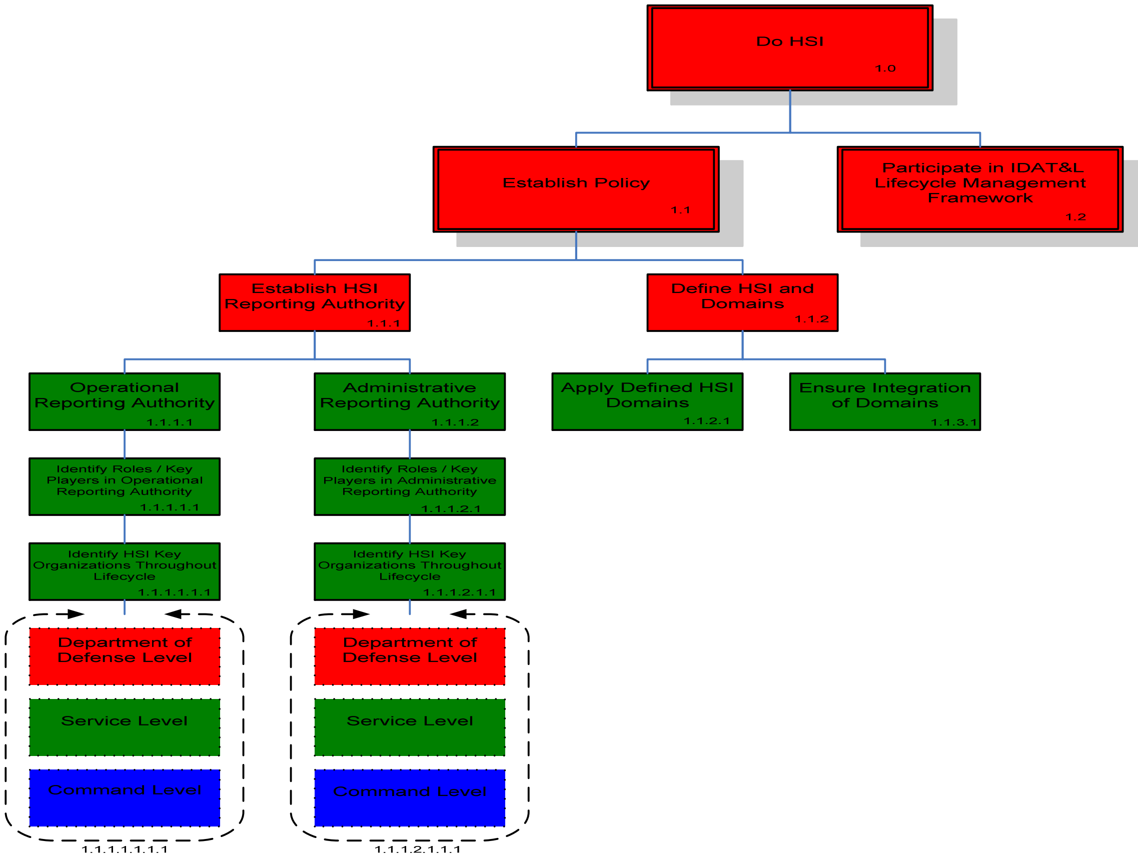

Figure 20. The Ideal Model (Policy Side)

Along with a reporting authority designated for the operational and administrative chains of command, HSI roles and key players must be identified. Without the identification of specific roles and key players, HSI cannot be effectively completed within the acquisition process. To ensure the effective completion of HSI throughout the entire acquisitions process, we recommend that these roles and key players be identified.

Having a single HSI definition and list of domains satisfies the requirements for the highest level of documentation, but we realize that at the lower levels there must be more direction. Currently, there is a gap within both documents at this level. To effectively accomplish HSI in the acquisition Life Cycle, the application and integration of the definition and domains must be present. For example, if an acquisition program has multiple services, a common set of domains and definitions are essential, as each service emphasizes different domains, as noted in Chapter I.

HSI Key Players throughout the Phases of the Life Cycle recommendations are identified in Level 1.

The recommendations of the different phases can be found in Level 1.

The OPNAVINST 5310.32 is strictly geared towards the JCIDS process and HSI within that process. Therefore, there are gaps that can be found from the lack of direction for the Transition Criteria from Materiel Solutions Analysis Phase to Technology Development Phase, the Transition Criteria from Technology Development Phase to Engineering and Manufacturing Development Phase, and the Transition Criteria from Engineering and Manufacturing Development Phase. Each of these transitions must be addressed to ensure that HSI is being done throughout the entire Acquisition Life Cycle. The SECNAVINST states that "the PM and sponsors shall address HSI throughout all the phases of the acquisition process" (DoN, 2008, p. 12 (b)). The simple wording of "shall" means that this is required to be addressed, but not necessarily documented. In order to optimize the effects of our systems, HSI must and should be addressed and documented throughout all of the phases. Wording can seem mundane, but the effects of a single word can mean not having to do a portion of what should be required.

As a whole, the Level 2 documents seemed to be laid out in such a way as to properly facilitate the use and management of HSI. However, there are still many gaps that can be fixed to optimize the effects HSI can have on a program.

F. DOCUMENT GAPS AT LEVEL 3

1. Virtual SYSCOM Human Systems Integration Guide, Volumes 1 and 2

This document was established by the Virtual SYSCOM in 2005. Their purpose is to unify the practices and methods used within the different SYSCOM to develop and integrate HSI to the Life Cycle. We have included the portions of the model that pertain to each level to allow the reader to visually see where the gaps are in each level on the model for this specific document. The boxes that have a yellow outline are the gaps we have identified. Additionally, the gaps are also listed in bullet format. Figure 21 shows the gaps in the policy side of the model for this document. Figure 22 shows the gaps in the operational side of the model through TD for this document. Figure 23 shows the gaps in the operational side of the model through OS for this document.

- Establish HSI Reporting Authority
- Operational Reporting Authority
- Administrative Reporting Authority
- Identify Roles/Key Players in Operational Reporting Authority
- Identify Role/Key Players in Administrative Reporting Authority
- Identify HSI Key Organizations throughout Life Cycle at the Command Level (Operational)
- Identify HSI Key Organizations throughout Life Cycle at the Command Level (Reporting)
- Identify HSI Key Players throughout the Phases of the Life Cycle
- Acknowledgement of Materiel Solution
- Name Materiel Solution Manager
- Materiel Development Decision
- User Input/Feedback (MSA)
- Draft KPPs
- PDR
- KPPs (TD)
- User Input/Feedback (TD)
- Name Program Manager
- KPPs (EMD)
- Post- PDR Assessment
- Post- CDR Assessment
- Integrated System Design
- CDR
- User Input/Feedback (EMD)
- Developmental Test and Evaluation
- User Input/Feedback (PD)

- Operational Readiness Assessment
- Implement Maintenance Objectives (PD)
- Implement Training Plan
- Life Cycle Sustainment
- User Input/Feedback (OS)
- Document Lessons Learned
- HSI Action Plan
- Implement Maintenance Objectives (OS)

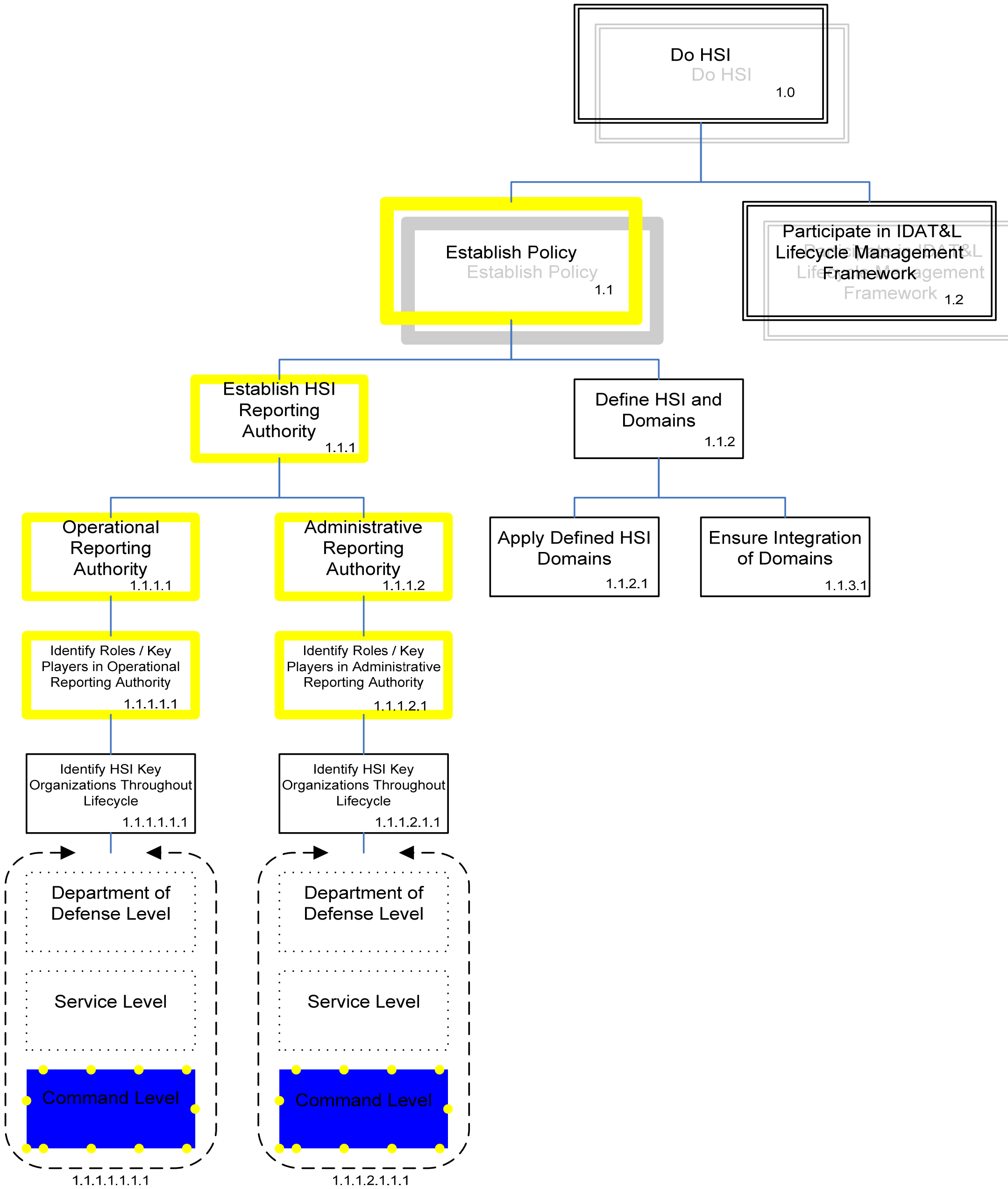

Figure 21. Gaps Identified in VS HSI Guide Vols. I and II (Policy Side)

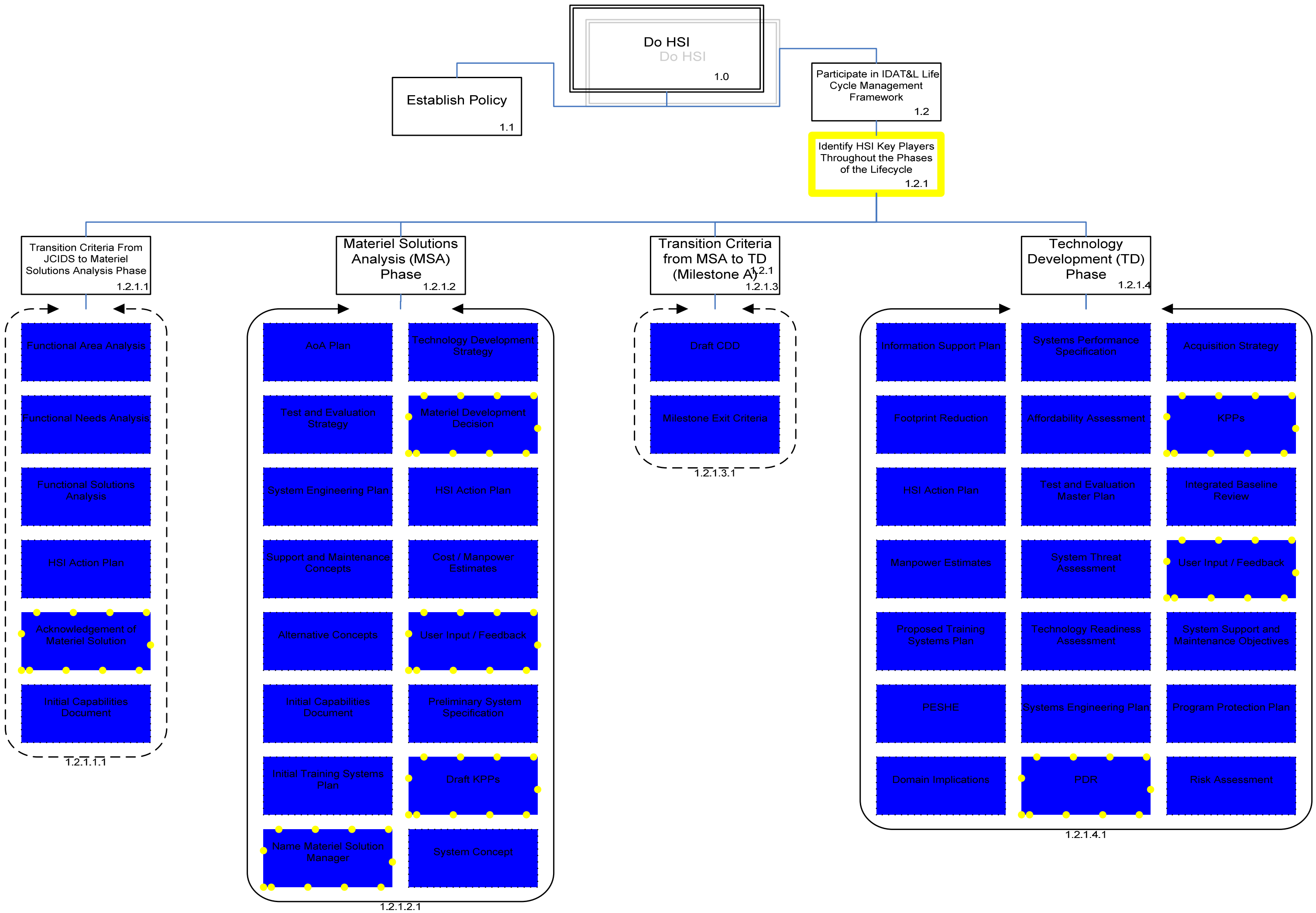

Figure 22. Gaps Identified in VS HSI Guide Vols. I and II (Operational Side through TD)

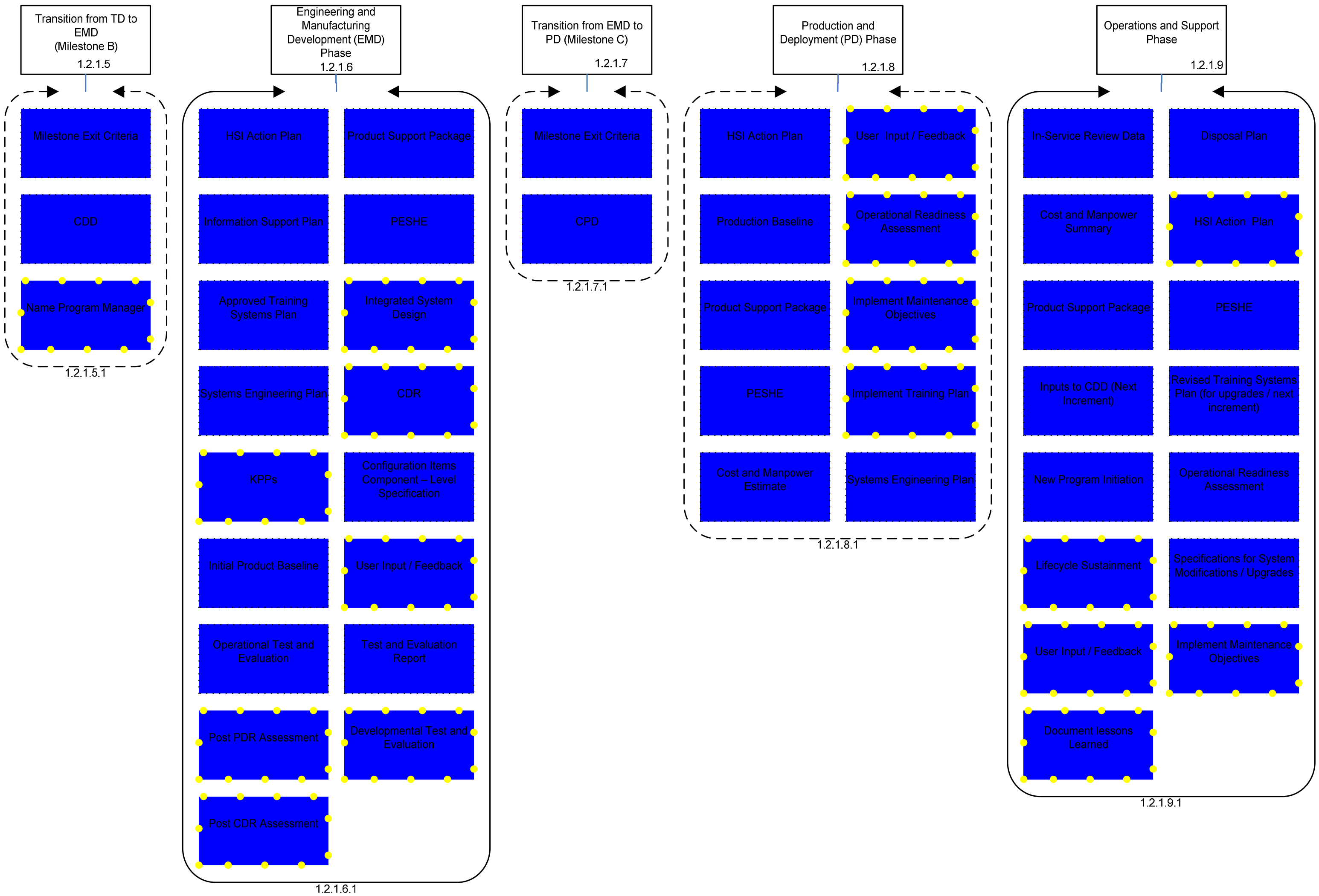

Figure 23. Gaps Identified in VS HSI Guide Vols. I and II (Operational Side through OS)

2. NAVSEA HSE Best Practices Guide

This document was established by NAVSEA in 2009. The purpose is to unify the practices and methods used within the NAVSEA to develop and integrate HSI within systems engineering and the Life Cycle. We have included the portions of the model that pertain to each level to allow the reader to visually see where the gaps are in each level on the model for this specific document. The boxes that have a yellow outline are the gaps we have identified. Additionally, the gaps are also listed in bullet format. Figure 24 shows the gaps in the policy side of the model for this document. Figure 25 shows the gaps in the operational side of the model through TD for this document. Figure 26 shows the gaps in the operational side of the model through OS for this document.

- Establish Policy
- Establish HSI Reporting Authority
- Define HSI and Domains
- Operational Reporting Authority
- Administrative Reporting Authority
- Identify Roles/Key Players in Operational Reporting Authority
- Identify Roles/Key Players in Administrative Reporting Authority
- Identify Key Players throughout the Phases of the Life Cycle
- Test and Evaluation Strategy
- Name Materiel Solution Manager
- User/Input Feedback (MSA)
- Preliminary System Specification
- Draft KPPs
- Information Support Plan (TD)
- Footprint Reduction
- Proposed Training Systems Plan
- System Performance Specification (TD)
- Technology Readiness Assessment
- PDR

- Acquisition Strategy
- KPPs (TD)
- Integrated Baseline Review
- User Input/Feedback
- System Support and Maintenance Objectives
- Program Protection Plan
- Milestone Exit Criteria (Milestone B)
- Name PM
- Information Support Plan (EMD)
- Approved Training Systems Plan
- KPPs (EMD)
- Initial Product Baseline
- Post- PDR Assessment
- Post- CDR Assessment
- Product Support Package (EMD)
- CDR
- Configuration Items Component – Level Specification
- User Input/Feedback (EMD)
- Milestone Exit Criteria (Milestone C)
- Production Baseline
- Product Support Package (PD)
- PESHE (PD)
- Cost and Manpower Estimate (PD)
- User Input/Feedback (PD)
- Operational Readiness Assessment (PD)
- Implement Maintenance Objectives (PD)
- Implement Training Plan
- In-service Review Data
- Cost and Manpower Summary

- Product Support Package (OS)
- Inputs to CDD (Next Increment)
- New Program Initiation
- Life Cycle Sustainment
- Disposal Plan
- PESHE (OS)
- Revised Training Systems Plan (for upgrades/next increment)
- Operational Readiness Assessment (OS)
- Implement Maintenance Objectives (OS)

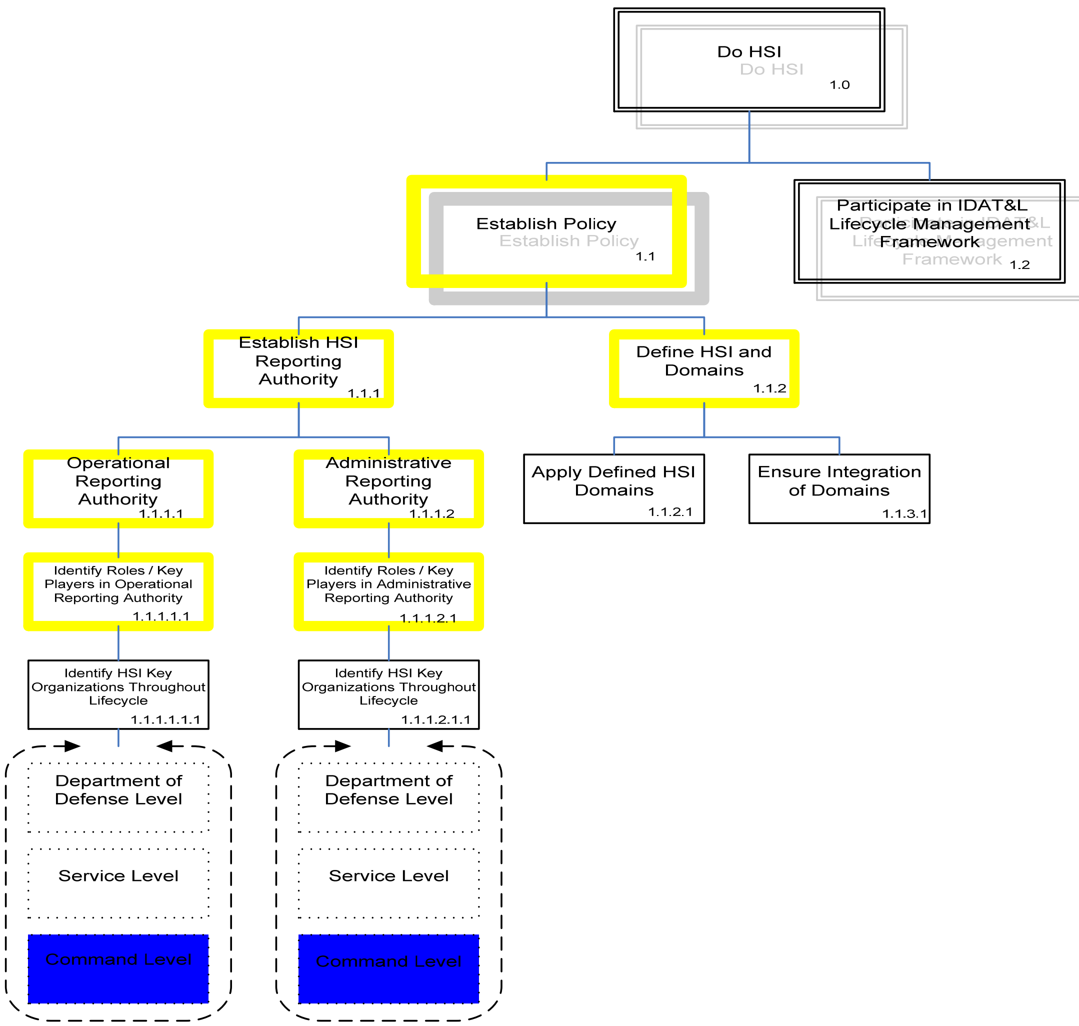

Figure 24. Gaps Identified in NAVSEA HSE Best Practices Guide (Policy Side)

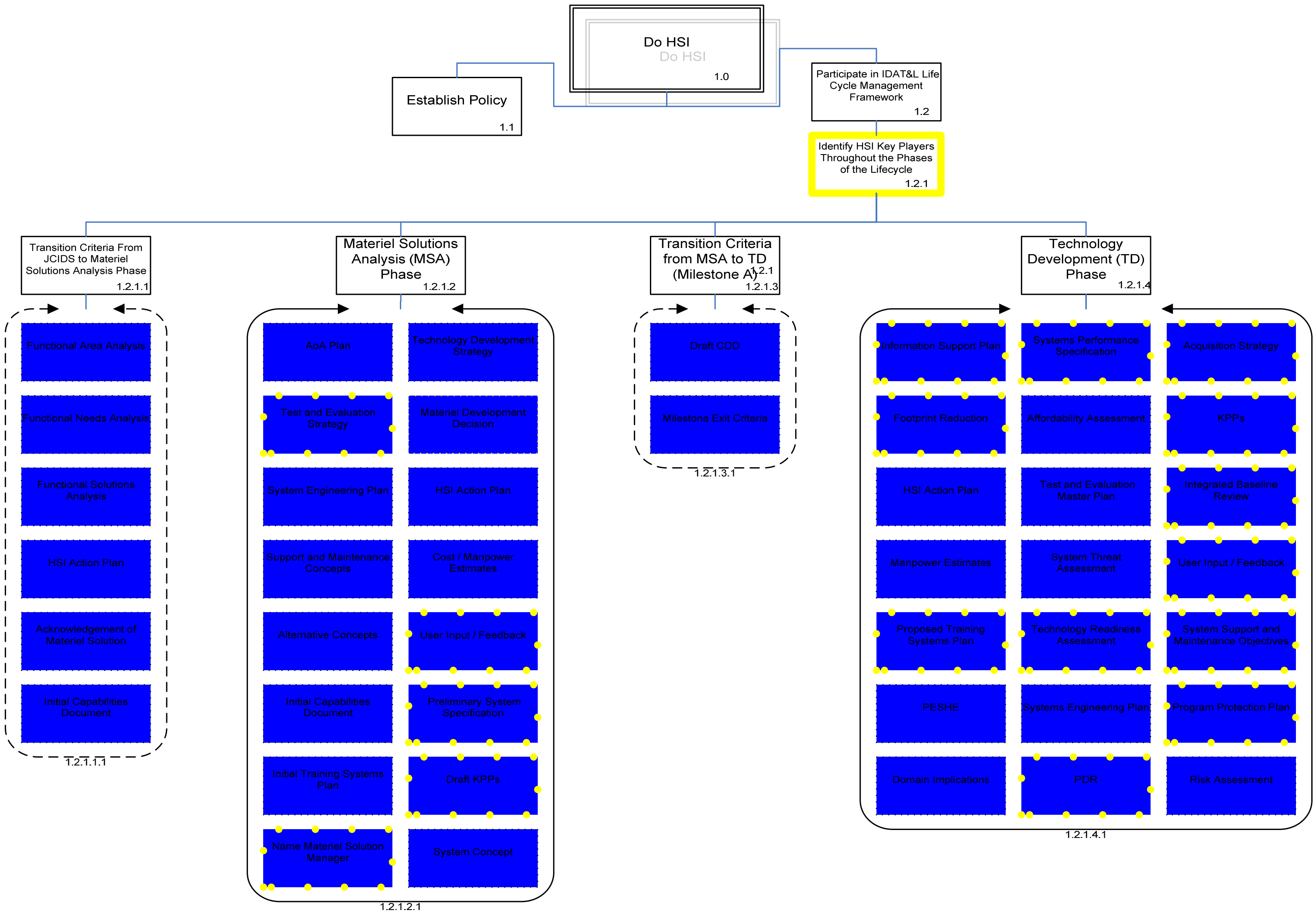

Figure 25. Gaps Identified in NAVSEA HSE Best Practices Guide (Operational Side through TD)

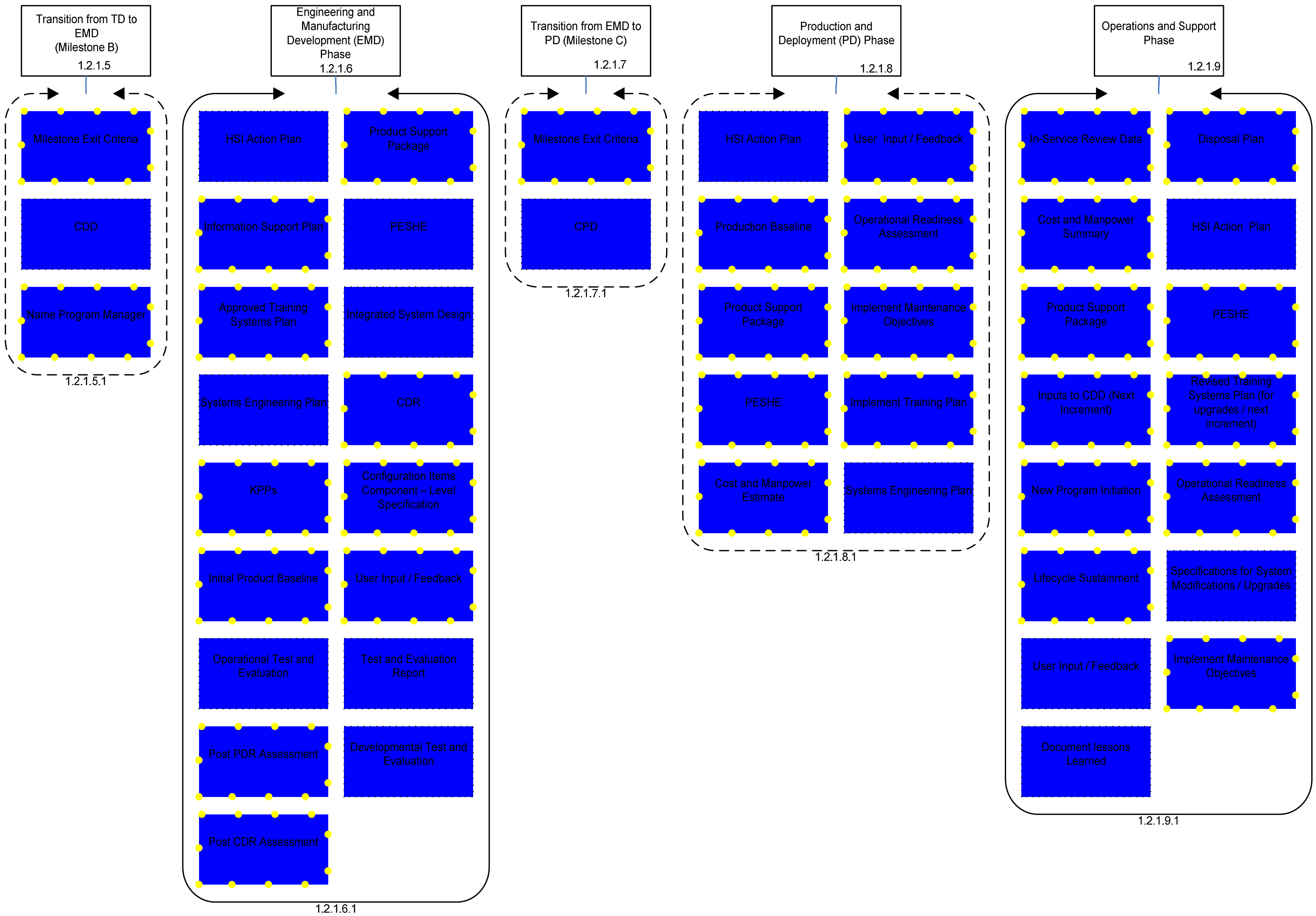

Figure 26. Gaps Identified in NAVSEA HSE Best Practices Guide (Operational Side through OS)

3. Recommendations for Level 3 Documents

The *Virtual SYSCOM'S Human Systems Integration Guide*, Volumes 1 and 2 and NAVSEA's *HSE Best Practices Guide* are unique documents in our analysis. They cannot be considered true policy for the Navy, but rather are guidance documents that were created as a reference for those participating in HSI activities throughout the Navy. With this in mind, in some instances, we have recommendations that were not originally intended for these documents, due to changes and revisions within the entire HSI process.

The recommendations for the following were previously stated and in Levels 1 and 2 recommendations. Establish HSI Reporting Authority, Define HSI and Domains, Operational Reporting Authority, Administrative Reporting Authority, Identify Roles/Key Players in Operational Reporting Authority, Identify Roles/Key Players in Administrative Reporting Authority, and Identify Key Players throughout the Phases of the Life Cycle.

A gap that has been noted within the *Virtual SYSCOM HSI Guide,* Volumes 1 and 2, is the lack of acknowledgement of a materiel solution. This can be attributed to the fact that this guide is somewhat outdated and does not contain the changes that have been made to the Life Cycle, to include phase changes that are documented in DoDI 5000.02. Regardless, there must be an acknowledgment of the materiel solution in order to move through the Life Cycle. An HSI practitioner should be involved in this process to ensure that HSI is being considered from the start of the program.

The Preliminary System Specification was not addressed by the HSE Best Practices Guide. This step, along with the revisions of the System Specification, which will be discussed later, is a very important aspect of the acquisition of a system. Everything that is considered in this step, must have an HSI practitioner to oversee the parameters that are discussed.

A T&E strategy is critical from the start of the design of the system. Along with the establishment of a T&E strategy, an HSI practitioner should be involved with the entire T&E process, including the developmental and operational testing of the program, to ensure that all domains are being carefully tested. A gap is present in the *HSE Best*

Practices Guide and it is therefore recommended that HSI be fully integrated with the development of a T&E strategy early in the Life Cycle.

A significant gap that we found within our analysis is the PM being the position that is in charge of HSI. We have stated throughout our research that it is imperative to have HSI throughout the entire acquisition Life Cycle. If the PM is the person in charge of overseeing HSI, then there is a gap until the PM is named after Milestone B. This means that there is no position that oversees HSI within that program for most of the beginning of the acquisition process. Therefore, we recommend that a Materiel Solution Manager be named after a materiel solution has been identified. This person will oversee HSI until the PM is named and is fully briefed on what has been occurring throughout the program up to that point. The Materiel Solution Manager can be seen somewhat as an Executive Officer, who will be responsible for the HSI portions until the PM comes onboard and is fully briefed. This ensures that there is a "chain of command," or a position of authority, on documentation and any recommendations that need to be made with regard to HSI prior to the involvement of the PM.

To ensure that the user is involved with the acquisition process, we have implemented a User Input/Feedback loop into each phase of the Life Cycle. Having the input of the user is imperative and would greatly increase the effectiveness of how the program is carried out. Therefore, we have identified gaps in both documents where the documents do not adequately involve the user for helpful feedback. For each phase that has a gap identified, we recommend a formal process of some sort to allow the user to give feedback to the key players for the program. There must be an HSI practitioner present at these feedback sessions to gain knowledge, suggest information, and handle any problems related to HSI.

Draft KPPs and KPPs are very important to the Acquisition Life Cycle. The continuous development of KPPs throughout the different phases is imperative for the development and production of the system. HSI practitioners must be involved in the development of KPPs from the draft throughout the entire process.

The Information Support Plan, Footprint Reduction, System Performance Specification, Technology Readiness Assessment, Acquisition Strategy, Integrated Baseline Review, and Program Protection Plan are all important parts of the Technology Development Phase. Each of these is integral in the successful acquisition of a system and must have an HSI practitioner involved to ensure that the program is considering all the domains of HSI. The *Best Practices Guide* does not fully incorporate the importance of HSI and these key activities within the acquisition process. As stated previously, “the PDR will inform requirement trades; improve cost estimation; and identify remaining design, integration, and manufacturing risk” (DoD 5000.02, 2008, p. 19). We acknowledge that the documents at this level have not been updated to include the new changes that have been made to DoD 5000.02. Yet, we want to make clear that it is imperative to have an HSI practitioner involved in the development of the PDR.

The *HSE Best Practices Guide* does not fully address the importance of HSI at the Milestone Exit Criteria. The criteria allow programs to proceed into the next phase of the acquisition process. If the Milestone Exit Criteria are not met, the program will not proceed. The HSI trade-offs and domains must be examined during these Milestone reviews. Therefore, an HSI practitioner must be involved in the discussions or considerations for the next phase.

The Post-PDR Assessment is an “assessment conducted by the PM and Milestone Decision Authority to ensure that the PDR report reflects any requirements trades based on the assessment of cost, schedule and performance risk” (DoD, 2008, p. 21). The Post-CDR Assessment is an assessment of “design maturity as evidenced by measures such as: successful completion of sub-system CDRs; the percentage of hardware and software product build-to specifications and drawings completed and under configuration management…” (DoD, 2008, p. 21). None of these new additions has been added to any of the documents at this level.

The Integrated System Design ensures that each HSI need and constraint is managed throughout the entire Life Cycle. The need for having an HSI practitioner involved in the Integrated System Design is obvious. Each document must contain information about the program having an Integrated System Design.

The CDR, PDR,and post-assessment activities have not been updated in either the *Virtual SYSCOM HSI Guide* or the *HSE Best Practices Guide*; therefore, we recommend that these documents be updated to contain the CDR and to include an HSI practitioner in the future.

To plan and develop a program that will create a successful system, many items must be taken into consideration. One item of great importance is a maintenance plan. This cannot be developed at the end of the Acquisition Life Cycle, but it must be done in the beginning to ensure that maintenance aspects are considered while it is still cost effective to do trade-offs. Having the maintenance practitioners involved with the process is essential. When the maintenance practitioners are developing their maintenance manuals, HSI practitioners must be involved in learning and developing effective maintenance techniques and to be able to design a system that will allow for minimal maintenance. If HSI is not involved until after the manuals are written, it is too late. Although the documents discuss maintenance plans, they do not effectively integrate the maintenance practitioners and the HSI practitioners throughout the entire Life Cycle.

Training plans are just as important as maintenance plans. As stated above, the training practitioners and HSI practitioners should work hand-in-hand throughout each phase of the Life Cycle to develop training programs and training systems that enhance system performance. The documents touch on training, but do not provide enough guidance to either training or HSI practioners. In many of the previous acquisition programs, HSI lessons learned were rarely documented.

The Operational Readiness Assessment is another part of the acquisition process that must include HSI involvement. As the Operational Readiness Assessment is updated, the HSI practitioner should be a participant in determining readiness and making any suggestions that would benefit the program.

Many items must be completed, reviewed, and discussed throughout the Engineering and Manufacturing Development Phase. Some of the specific requirements during this phase that were not discussed in the *HSE Best Practices Guide* include: Information Support Plan, Initial Product Baseline, Product Support Package, and

Configuration Items Component—Level Specification. These are all required for this phase; having an HSI practitioner involved will enhance the design and production of the system.

Our model has a reduced HSI requirement for the Production and Deployment Phase, but this does not mean that HSI should not be considered throughout this phase. The *HSE Best Practices Guide* must include the continuation of HSI practitioners participating in the following gaps: Production Baseline, Product Support Package, PESHE, Cost and Manpower Estimate, and Operational Readiness Assessment. These are all critical to the continuing development of HSI throughout the entire Life Cycle.

The Operations and Support Phase, just as the Production and Deployment Phase, has often left out HSI practitioners. Many HSI considerations are imperative for the successful deployment of a system. The *HSE Best Practices Guide* contains gaps in addressing HSI in the following criteria required for the Operations and Support Phase: In-Service Review Data, Cost and Manpower Summary, Product Support Package Inputs to CDD (Next Increment), New Program Initiation, Life Cycle Sustainment, Disposal Plan, and PESHE. Each of these must be addressed to ensure that HSI is performed throughout the entire Life Cycle and to ensure the effectiveness of the system.

Overall, level 3 was difficult to analyze because of the differences between the two documents. The *Virtual SYSCOM HSI Guide* and the *HSE Best Practices Guide* are very informative with regard to HSI and have established an excellent baseline of information for those currently doing HSI. If the gaps that we have identified are addressed, each of these documents will enhance our acquisition of systems, with respect to HSI.

V. CONCLUSIONS AND RECOMMENDATIONS

A. OVERVIEW

Based on the gaps and recommendations derived from the gap analysis performed in Chapter IV, this chapter addresses major areas for immediate change within the Navy and proposes alternative solutions to enhance overall HSI continuity and effectiveness across the acquisition framework. Recommendations for areas of future study in the field of HSI will also be made.

B. CONCLUSIONS

The DoD and Level 1 documentation do not appear to possess policies or effective procedures to systematically integrate HSI into the materiel acquisition process. To date, the DoD and DoN have not established adequate policies or procedures for the application, execution, support, and integration of HSI into the acquisition framework and Life Cycle. To achieve information exchange and adequate guidance in the field of HSI, the Navy relies on piecemeal documentation and expertise within its SYSCOMs.

These current practices fail to achieve the benefits gained by using an integrated and comprehensive approach to ensure that appropriate documentation and guidance are set for each level. Consequently, the Navy is failing to optimize total system performance, with respect to the human, in the acquisition Life Cycle.

The effectiveness of the Navy's HSI Program is driven by the operational expertise and acquisition experience at the SYSCOM level. Limited guidance, and nonstandardized HSI policies and procedures, force the SYSCOM-level commands to rely on the HSI knowledge they have in-house to successfully establish and execute HSI efforts. Without standardized HSI policies and procedures, the Navy relies on the personnel in HSI billets and roles to establish and execute HSI efforts. This practice results in inconsistent application, performance, and support among programs—with regard to HSI—as well as creating a large variability between programs within the same or similar acquisition categories.

The consequences of this variability can be lessened by changing the organizational culture and providing adequate guidance throughout the Acquisition Life Cycle. By empowering more than just the PM to do HSI, there will be better communication and effectiveness of managing HSI-related concerns throughout the entire acquisition effort.

Current HSI policy and practices in the Navy do not involve the system user enough in the acquisition and decision-making processes. The user is granted limited visibility and feedback opportunities throughout the acquisition process. Currently, there are only three places throughout the Life Cycle when the user may have visibility, depending on the discretion of the PM. This current system does not allow the user to effectively influence system design with regard to human considerations. Rather, it clouds the understanding of HSI roles and responsibilities.

By using the model created for this thesis, the current policies and practices were assessed and found to be inadequate. Human-related issues are often not raised, documented, tracked by an audit trail, or assessed by HSI specialists. These gaps in documentation lead to the breakdown of HSI throughout the IDAT&L Life Cycle Management Framework, and make it extremely difficult to review the effectiveness of the HSI decision-making process regarding the program's status.

The successful implementation of HSI into the acquisition process throughout the entire Life Cycle must be founded on the basis of senior DoD and Navy officials. To achieve service-wide implementation of HSI, the DoD and Navy must rely on a top-down management approach and the buy-in of senior Navy officials in order to institute and sustain an effective HSI program that spans the entire acquisition Life Cycle. Without this senior level buy-in, the program will falter and miss its goals.

C. AREAS FOR FURTHER RESEARCH

During this research, other areas of study were identified that would strengthen the practice of HSI. These topics were beyond the scope of study for this research, but are presented as potential research topics for consideration.

Gap/comparative analysis of the current HSI documentation for all other DoD agencies, including other services (Air Force, Army, Marine Corps, etc.)

Whereas this thesis focused solely on the Navy's use of HSI, no research has been conducted on the gaps that lie within the other DoD agencies' and services' documentation with regard to HSI in the IDAT&L Life Cycle Management Framework. The same model used in this thesis can be used as a baseline for other service policies. Recommendations can be made to fill gaps in these HSI documents and policies as well. These gap analyses can then be used in a larger comparative analysis to ensure that appropriate changes are being made at the highest level, to affect all DoD agencies and services.

Analysis of the trade-space tools used/needed to address and fill the gaps identified throughout the IDAT&L Life Cycle Management Framework.

In order to effectively close the gaps identified in this thesis, an analysis of trade-space tools should be done based on the needs of each document. As seen throughout this thesis, change must be made on every level and that change must also be able to provide a smooth transition between document levels. To effectively accomplish this, trade-space tools must be used and/or created. These same tools can then be used to assess the effectiveness of HSI.

Analysis of the effects of current Navy HSI policies and procedures on overall system procurement.

As mentioned earlier, due to current documentation and policy gaps, it is rather difficult to trace HSI throughout system procurement. An analysis of the effects of current HSI policies and procedure on overall system procurement should be done to allow a thorough review to occur once changes have been made to policy regarding HSI. This review should allow top-level officials, as well as all personnel involved in the HSI process, to track changes and gain insight for areas of future improvement.

Comparative cost and effectiveness analysis of the Navy's HSI support sources.

Further study should be done on the cost effectiveness of alternative approaches for sourcing and employing HSI support within the DoD acquisition framework. Future research should look at the cost effectiveness of both military and contracted HSI support services, as well as all combinations of the above. The end goal is to minimize overall cost, while still retaining expert skills in HSI specialists.

APPENDIX THE IDEAL MODEL

This model is the same model shown throughout the thesis. The model is broken down into three separate diagrams for viewing purposes only. Figure 27 shows the policy side of the model. Figure 28 shows the operational side of the model through TD. Figure 29 shows the operational side of the model through OS.

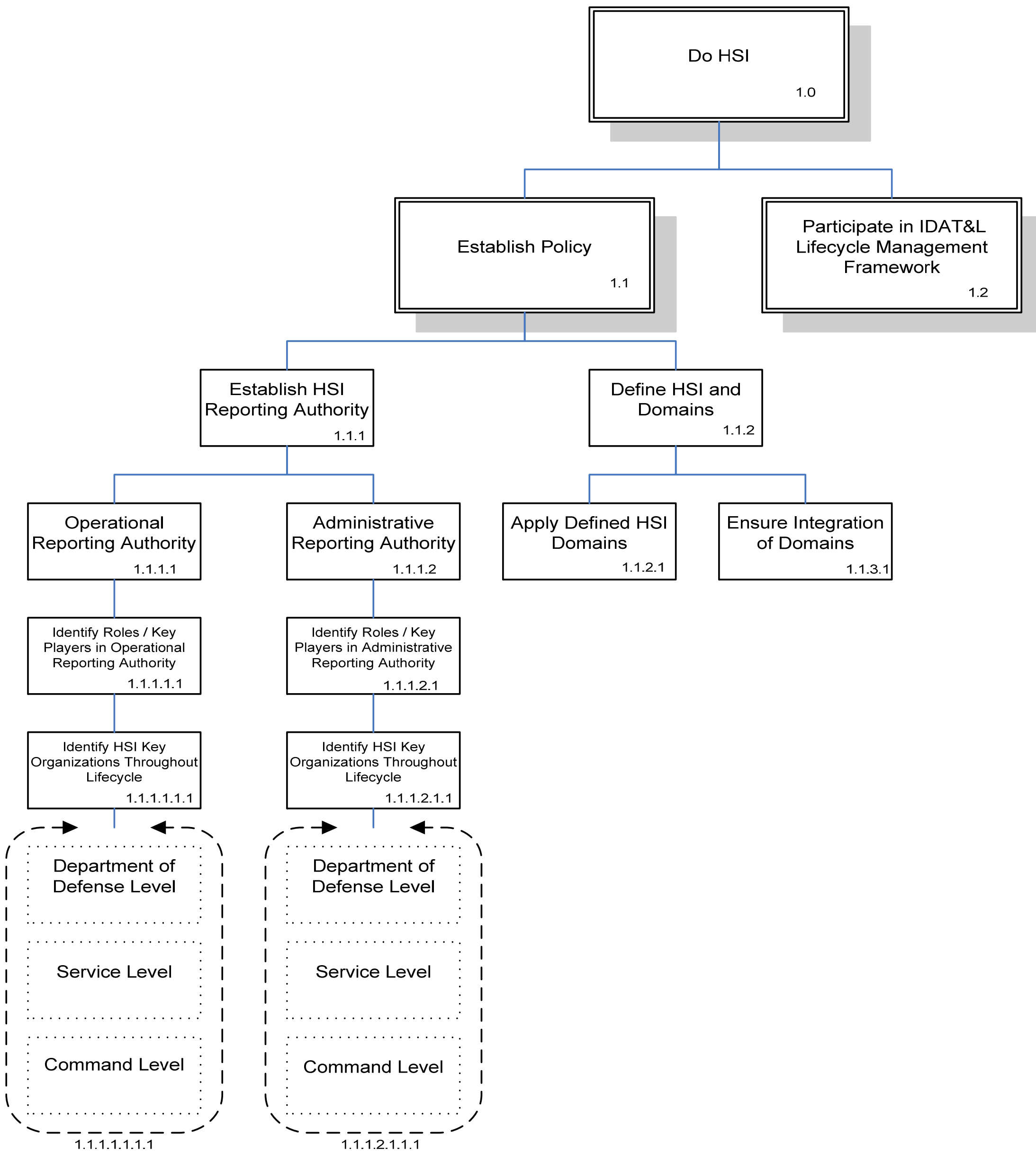

Figure 27. The Ideal Model (Policy Side)

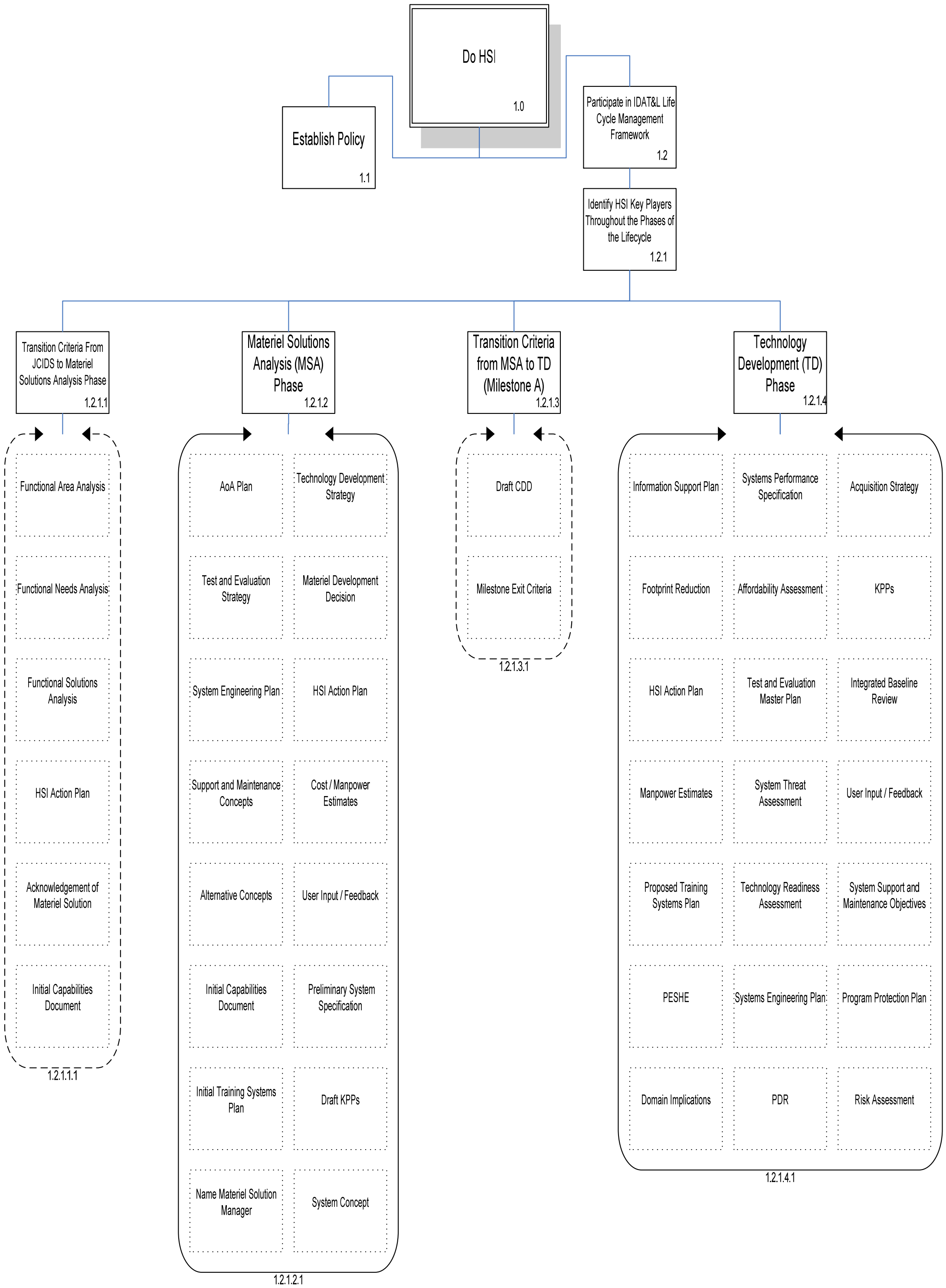

Figure 28. The Ideal Model (Operation Side through TD)

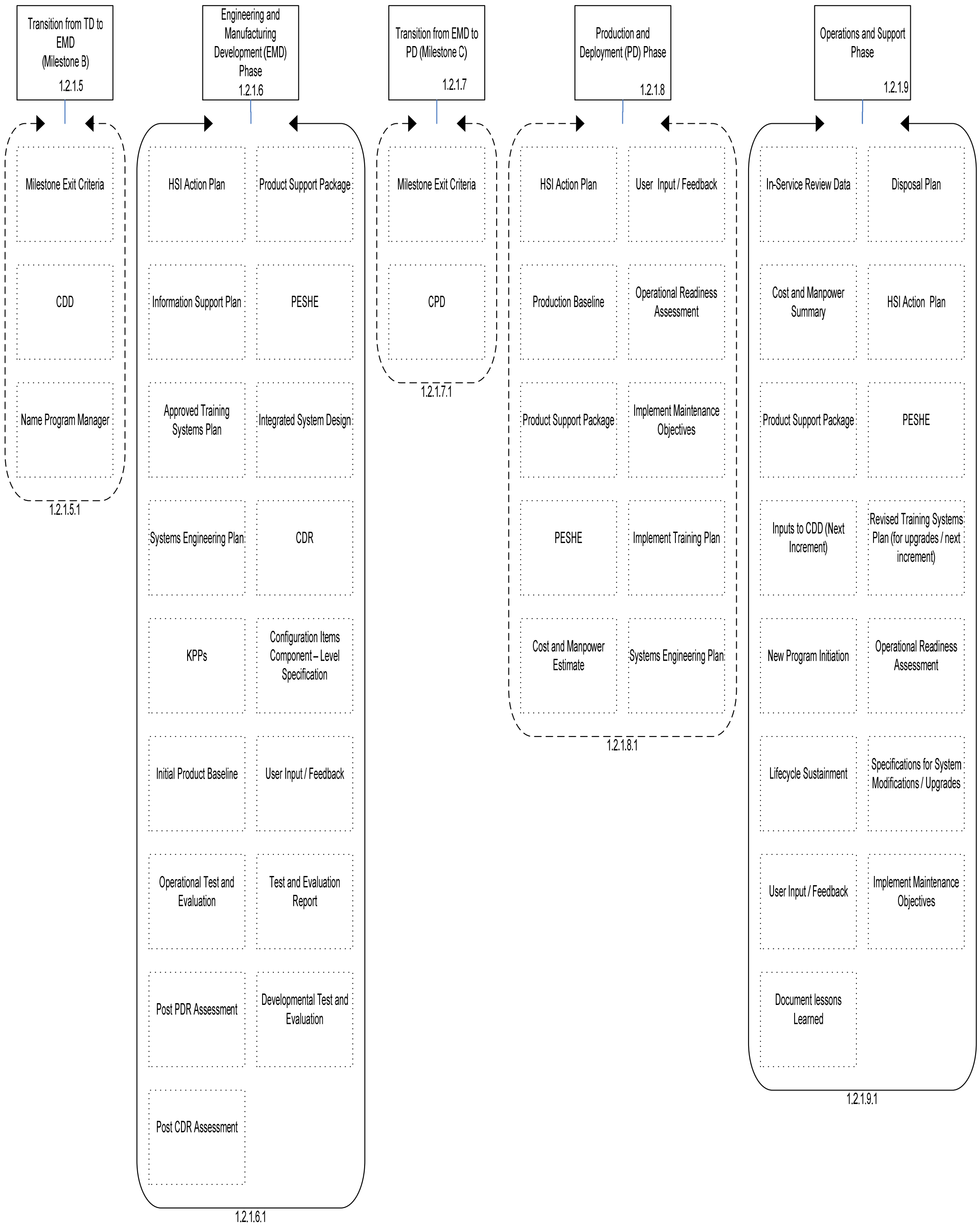

Figure 29. The Ideal Model (Operational Side through OS)

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